HEWLETT® PACKARD

User's Guide

HP High Speed Internet Advisor

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Hewlett-Packard Company
Network Test Division
5070 Centennial Boulevard
Colorado Springs, Colorado 80919-2497

Safety Information

Before you use this instrument, be sure to pay special attention to the "Safety" and "Warning" sections in this Manual. Failure to comply with the precautions or with specific warnings in this book violates safety standards of design, manufacture, and intended use of this instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

Electric Shock Hazard. Do not remove the system covers. To avoid electric shock, use only the supplied power cords and connect only to properly grounded (3-pin) wall outlets.

Explosion Hazard. Do not operate in the presence of flammable gases.

Fire Hazard. For continued protection against fire hazard replace only with fuse of same type and rating.

Hazardous Material. Should the LCD be damaged the liquid crystal material can leak. Avoid all contact with this material, especially swallowing. Use soap and water to thoroughly wash all skin and clothing contaminated with the liquid crystal material.

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Product Damage. Do not use this product when:

- the product shows visible damage,
- fails to perform,
- has been stored in unfavorable conditions,
- or has been subject to severe transport stresses.

Make the product inoperative and secure it against any unintended operation. Contact your nearest Hewlett-Packard Sales office for assistance.

Warning Symbols Used in This Book:

Instruction book symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction book in order to protect against damage.

Indicates potential for electrical shock.

WARNING

An operating procedure, practice, etc. which, if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed, could result in damage to, or destruction of, equipment or software.

Conventions Used in this Book

The following are examples of the conventions used in this book:

NOTE

An operating procedure, practice, or information of importance separated from normal text.

> **Boxed Information**
>
> Explanatory comments or supplementary instructions are presented in boxed format.

Instrument keys are shown as **F3** (Printer Setup), **PgDn**, and Down Arrow.

Toolkit choices and configuration fields are shown as **BERT Analyzer** and **Interface Type**.

Text that you should enter is shown as `Yes`.

Internet Advisor output, directories, files, and example results are shown as `Example Output`.

Text that is emphasized is shown as Do not execute something.

Operating Restrictions

The following warnings and operating information are shown in French followed by the English translation.

MISE ENGARDE Cet appareil répond aux normes de la «Classe de sécurité I» et est muni d'un fil de mise à la terre pour votre protection.

WARNING This product is a Safety Class I instrument with a protective earth terminal.

MISE ENGARDE Pour prévenir les risques de choc électrique, la broche de mise à la terre du cordon d'alimentation ne doit pas être désactivée.

WARNING For protection from electric shock hazard, power cord ground must not be defeated.

Restrictions d'utilisation
L'utilisateur se doit d'observer les mesures de précaution énumérées ci-dessous pour toutes les phases d'utilisation, de service et de réparation de cet appareil. Le fait de ne pas s'y conformer équivaut à ne pas respecter les mises en gardes spécifiques contenues dans ce manuel et constitue une violation des normes de sécurité relatives à la conception, la fabrication et l'utilisation prévue de cet appareil. La société Hewlett-Packard n'assume aucune responsabilité envers un client qui manquerait de se conformer à ces exigences.

Mise à la terre
Afin de minimiser les risques de choc électrique, le chÀssis et le cabinet de l'appareil doivent être mis à la terre. L'appareil est équipé d'un cordon d'alimentation muni d'une fiche homoloquée à trois lames, compatible c.a. La prise murale et la prise femelle de la rallonge électrique doivent respecter les normes de sécurité de la «Commision électrotechnique internationale» (IEC).

Operating Restrictions
The following general safety precatuions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions with specific warnings in this manual violate safety standards of design, manufacture, and intended use of this instrument.

Grounding
To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor AC power cable compatible with an approved three-contact electrical outlet. The power jack and mating plug of the power cord must meet International Electrotechnical Commission (IEC) safety standards.

Environnement
Ne faites pas fonctionner cet appareil en présence de gaz inflammables ou de vapeurs dangereuses. L'utilisation de n'importe quel appareil électrique dans ces conditions constitue un risque élevé pour votre sécurité.

Service et ajustement
Des «tensions dangereuses» résident dans cet appareil. Par conséquent, le service et l'ajustement doivent être effectués uniquement par une personne qualifiée.

Ne remplacez pas de composantes lorsque le cordon d'alimentation est sous tension. Il pourrait y avoir présence de «tensions dangereuses» même lorsque l'appareil est déconnecté.

Ne faites pas de service interne ou d'ajustement sauf en présence d'une autre personne, capable de prodiguer les premiers soins et de pratiquer la réanimation.

Manipulation du tube cathodique
Une manipulation brusque, ou le fait de secouer l'appareil, peut provoquer le bris du tube cathodique. L'implosion que s'en suivrait entraînerait la dispersion à grande vélocité d'éclats de verre. Le retrait ou l'installation du tube cathodique ne doit être exécuté que par un technicien qualifié, portant un masque et des gants de sécurité homologués.

Matiere dangereuse
Si l'affichage LCD est endommagé, la matière constituant les cristaux liquides peut se répandre. Eviter tout contact avec cette matière, et en particulier ne pas l'avaler. Utiliser de l'eau et du savon pour nettoyer soigneusement la peau et les vêtements qui auraient été contaminés par la matière constituant les cristaux liquides.

Service non autorisé
L'installation de pièces étrangères, ou toute modification apportée à l'appareil sans le consentement de Hewlett-Packard est formellement interdit. Le fait de procéder à de tels modifications sans autorisation pourrait entraîner l'annulation de la garantie de l'appareil ou de tout contrat de service.

Pour un service et des réparations autorisées, retournez l'appareil à un point de vente et service Hewlett-Packard.

Environment
Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Service and Adjustment
Dangerous voltages exist within this instrument. Service and adjustment of this instrument is to be performed only by trained service personnel.

Do not replace components with the power cable connected. Dangerous voltages may be present even when the power cable is disconnected.

Do not perform internal servicing or adjustment unless another person, capable of rendering first aid and resuscitation is present.

CRT Handling
Roughhandling or jarring of the instrument can break the CRT (cathode ray tube). The resulting implosion will scatter glass fragments at high velocity. Removal or installation of the CRT is to be performed only by qualified maintenance personnel using approved safety mask and gloves.

Hazardous Material
Should the LCD be damaged the liquid crystal material can leak. Avoid all contact with this material, especially swallowing. Use soap and water to thoroughly wash all skin and clothing contaminated with the liquid crystal material.

Unauthorized Service
The installation of substitute parts or the installation of any instrument modification not authorized by Hewlett-Packard is specifically forbidden. The performance of such unauthorized service can negate the instrument warranty or any maintenance agreements.

Return the instrument to a Hewlett-Packard Sales and Service Office for authorized service and repair.

Printing History

New editions are complete revisions of this book. Update packages may contain new or additional material and be released between editions. See the date of the current edition on the back cover of this book.

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Additional Help

You can obtain additional assistance in the U.S.A. by:

Calling USA Help Line at (719) 531-4567
E-Mail ntd_helpline@hp0800.desk.hp.com
FAX (719) 531-4506

or Internationally by calling your local HP Sales Office.

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Introduction

Basic Features

The Hewlett-Packard J2300 Series Internet Advisor has all the needed tools to test data communications links from 50 bps to 2 Mbps. You can test networks at T1 or E1 rates with a variety of protocols.

The Internet Advisor is a multi-function data communications test instrument that was specifically designed to capture and display bit serial data from many common interface technologies. The Internet Advisor can collect statistical information as it captures data and you can use it to simulate devices found in communications links. In addition, it provides the common BERT (Bit Error Rate Test) measurements. The data rate in all modes is from 50 bits per second (bps) to 2048 kilobits per second (Kbps.)

The Internet Advisor is a ruggedized, personal computer combined with dedicated communication measurement hardware and a connection for an external VGA Monitor. It provides electrical interfaces conforming to RS-232/V.24-V.28, RS-449/V.36, V.35, and T1 or E1 recommendations. Optional interfaces can include X.21 and ISDN Basic Rate. Refer to Appendix A, "Internet Advisor Features," Appendix C, "Specifications," and the *Mainframe Features HP Internet Advisor* for more information on Internet Advisor hardware.

WARNING

The Internet Advisor comes with a three-conductor power cable that grounds the instrument when it is connected to an appropriate power outlet. Do not operate the Internet Advisor without ground protection. For protection from electric shock hazard, the power cord ground must not be defeated.

Protocols Supported

The Internet Advisor displays and decodes data from several levels of protocol. At the lowest level it gives access to RS-232/V.24, RS-449/V.36, V.35, T1, E1, and optional interfaces such as X.21 and ISDN Basic Rate.

NOTE

References throughout this manual to "V-Series" interfaces refer generically to the built-in RS-232/V.24, RS449/V.36, V.35, and External ports. References to "T1" refer to the removable T1 interface module and references to "E1" and "CEPT E1" refer to the removable E1 interface module.

The High Speed Analyzer capability of the Internet Advisor supports only synchronous bit oriented protocols (BOPs) at the link level. For character oriented protocols, such as BISYNC and for asynchronous protocols, use the Low Speed Analyzer capability of the Internet Advisor. HDLC and its derivative protocols are decoded and generated. Link Level Protocols include the following:

- HDLC High-level Data Link Control
- SDLC Synchronous Data Link Control
- PPP Point to Point Protocol
- LAP-B Link Access Procedure, Balanced-mode (X.25 Layer 2)
- LAP-F Link Access Procedure, Frame-relay
- SNAP Sub Network Access Protocol

Network level protocols such as X.25, Frame Relay, IP, and the most common LAN protocols encapsulated in WAN are decoded. Refer to the "Decoded Protocol Fields" section in Appendix C, "Specifications," for more information.

Overview Of Internet Advisor Tests

The basic functions of the Internet Advisor are to Monitor, Simulate, and perform BERT measurements. In addition, it can serve as a master or slave station in remote control operation. Refer to the "Remote/Slave Operations" section in the *HP Low Speed Internet Advisor User's Guide* for more information.

Monitoring is the passive capturing of bit serial data for the purpose of decoding and making statistical measurements. You can log data and results to the hard drive during or after a test. You can monitor a line to verify correct communications and to quantify line utilization and data throughput. In addition, you can use the Internet Advisor to monitor WAN traffic, monitor encapsulated LAN traffic, identify configuration problems, detect transmission errors, and determine traffic patterns. Refer to chapter 4, "Monitoring," for more information.

Simulating builds upon monitoring by adding the ability to generate bit serial traffic. This allows the Internet Advisor to participate in the communications either as a user or as the network. You can use simulation when you want to test and configure network devices, such as placing an X.25 or Frame Relay Call. Refer to chapter 5, "Simulating," for more information.

When monitoring and simulating, the Internet Advisor allows you to configure filters and counters to screen out or accept data and to count events of interest.

BERT (Bit Error Rate Testing) is a special case of simulating in which the Internet Advisor is used to send and receiver pseudo-random or stress patterns for the purpose of obtaining quantitative data regarding the error characteristics of a communications link or device. Refer to chapter 6, "BERT Analyzer," for more information.

Basic Operation

The Internet Advisor operates with a user interface called the Toolkit. Figure 1-1 shows the Toolkit power-on screen which is titled Main Group. This screen can vary depending on what you have added to Toolkit, such as ATM or TIMS test capability (if you have purchased and installed them). To activate a Toolkit function, use the arrow keys in the lower right corner of the keyboard to highlight the function and then press **ENTER**.

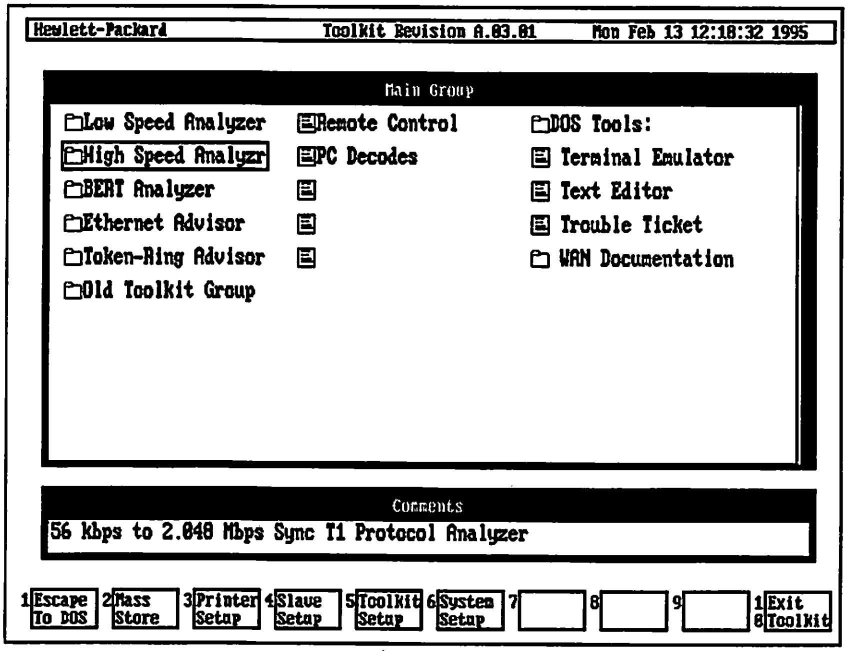


Figure 1-1: Main Group Screen

Each of the items in the Main Group screen (and other similar Toolkit screens) has one of two possible icons. The file-folder icon ( ) marks items that access groups of tests. Highlighting a file-folder icon and pressing **ENTER** displays the individual tests within that group, or displays additional groups. The page icon ( ) marks items that access a single tool or test. Highlighting a page icon and pressing **ENTER** starts the indicated test or function. Refer to chapter 7 "The Toolkit User Interface" for more information about configuring and using Toolkit.

You can use Toolkit to configure the Internet Advisor to run tests by pressing a single key. This allows you to quickly view the status of your network. The following are three of the Toolkit page icon ( ) choices provided from the Main Group screen:

- **Low Speed Analyzer** is the built-in hardware, firmware, and software system based upon the HP 4957A Protocol Analyzer, but is identified as the HP 4959A on Internet Advisor screens. Use this capability for asynchronous and isochronous testing from 50 bps to 64 kbps.

- **High Speed Analyzr** is the hardware and software system for testing synchronous communications links in the range of 50 bps through 2.048 Mbps.

- **BERT Analyzer** gives access to the synchronous BERT capability of **High Speed Analyzr**. It also offers the choice of running asynchronous BERT measurements through the **Low Speed Analyzer.**

Selecting **High Speed Analyzr** displays the **Main Group\High Speed Analyzr** screen as shown in Figure 1-2.

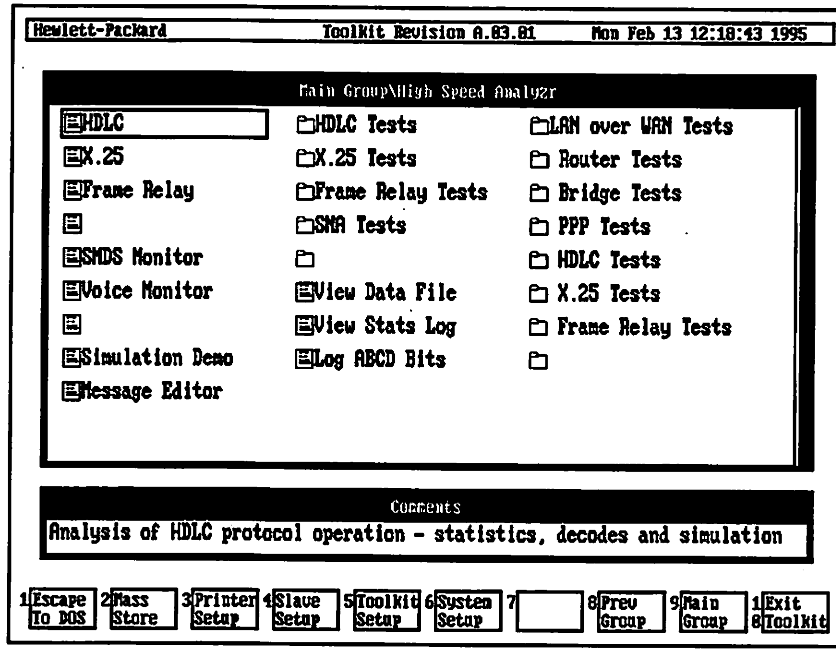


Figure 1-2: Main Group\High Speed Analyzr Screen

The following are page icon ( ) choices from the **Main Group\High Speed Analyzr Screen**:

- **HDLC, X.25, Frame Relay,** and **SMDS Monitor** (T1 operating system only) programs are generic tests for the specified protocol.
- **Voice Monitor** allows a T1 or E1 voice channel to be monitored through the handset.
- **Simulation Demo** creates simulated LAN over WAN traffic for demonstration, training, and verification purposes.
- **Message Editor** gives access to the message builder.
- **View Data File** and **View Stats Log** are programs which display previously captured data and statistics.

- **Log ABCD Bits** (T1 operating system only) provides a method to capture and display the in-band signalling bits common on many T1 telecommunication links.

The following are file-folder icon ( ) choices from the **Main Group\High Speed Analyzr Screen:**

- **HDLC Tests, X.25 Tests, Frame Relay Tests,** and **SNA Tests** give access to a number of preconfigured tests for the respective protocols where the filters and counters capability of the Internet Advisor is used to obtain additional protocol specific statistics.

- All of the folders under the **LAN over WAN Tests** title contain families of tests suited to the particular types of devices (and vendors) that place LAN type traffic on WAN links. The tests show protocol distributions and utilization of the WAN links. Statistics available include TCP/IP, DECnet, Novell, Appletalk, and Banyan. Refer to Appendix B, "Supplied Tests," for more information about these tests.

For some of the page icon ( ) selections the Internet Advisor goes directly into the Interface Setup Menu (shown in Figure 1-3). When this happens, you need to configure the interface for the desired test. You need to configure at least the **Interface Type, Run Mode, DTE Clock Src,** and **Data Sense.**

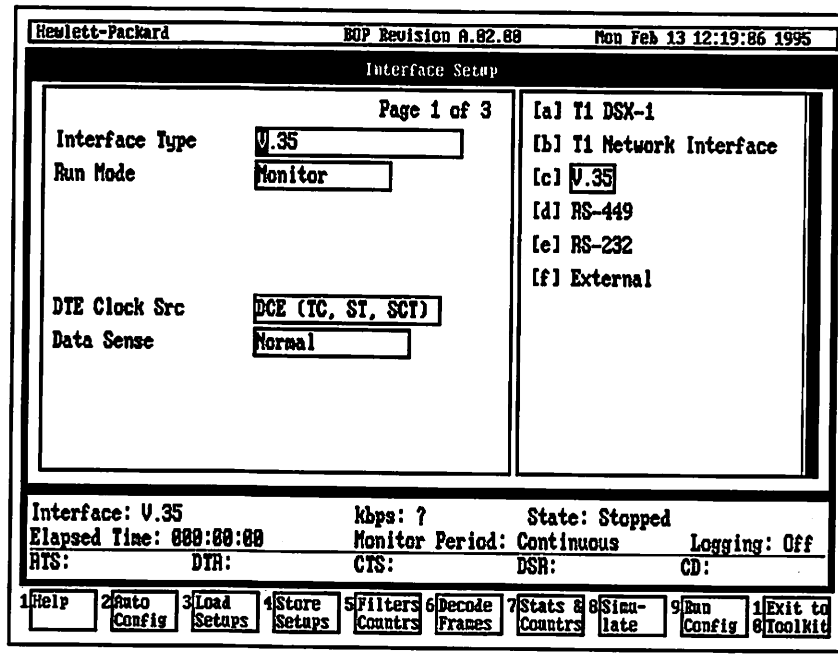


Figure 1-3: Interface Setup Menu

Once you have configured the interface you can press **F6** (Decode Frames) or **F7** (Stats & Countrs) to access the test. You can then press **F9** (Start Monitor) to begin the test and pressing **F9** (Stop Monitor) again ends the tests.

Figures 1-4 and 1-5 show Decodes and Statistics for a 64 kbps X.25 circuit using a V.35 interface.

Figure 1-4 shows a Summary Decode of X.25 traffic. It shows X.25 Layer 2 and X.25 Layer 3 header and trailer information along with time stamping of frames. Timing can be "real time" (synchronized to the DOS clock), "relative" to a chosen frame, or the "differential" (or delta) time between frames. The source of the frame is indicated as EQ (Equipment/DTE) or LN (Line/DCE).

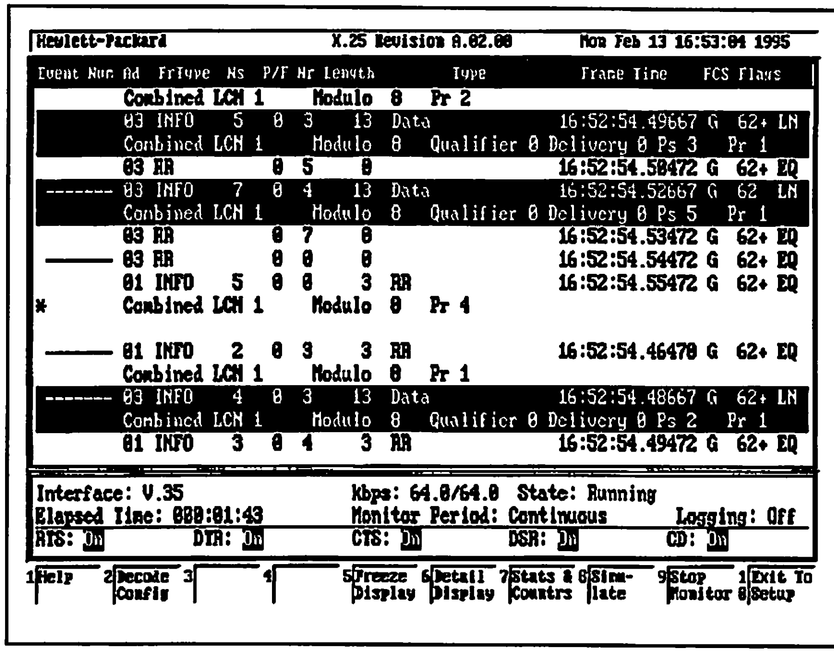


Figure 1-4: X.25 Decode

You have considerable flexibility in the presentation of decoded data. You can elect to display several levels of the protocol stack. Decode screens have an area at the bottom which indicates the mode of operation and the interface status. Refer to chapter 4, "Monitoring," for more information on configuring tests and interpreting data.

As the Internet Advisor captures data from the link, it also gathers statistical information which can be interpreted for maintenance and capacity planning purposes. Figure 1-5 shows a sample X.25 Statistics screen where no errors have occurred since the test began and the link utilization is low. As with decodes, the bottom of a statistics screen indicates the mode of operation and the interface status.

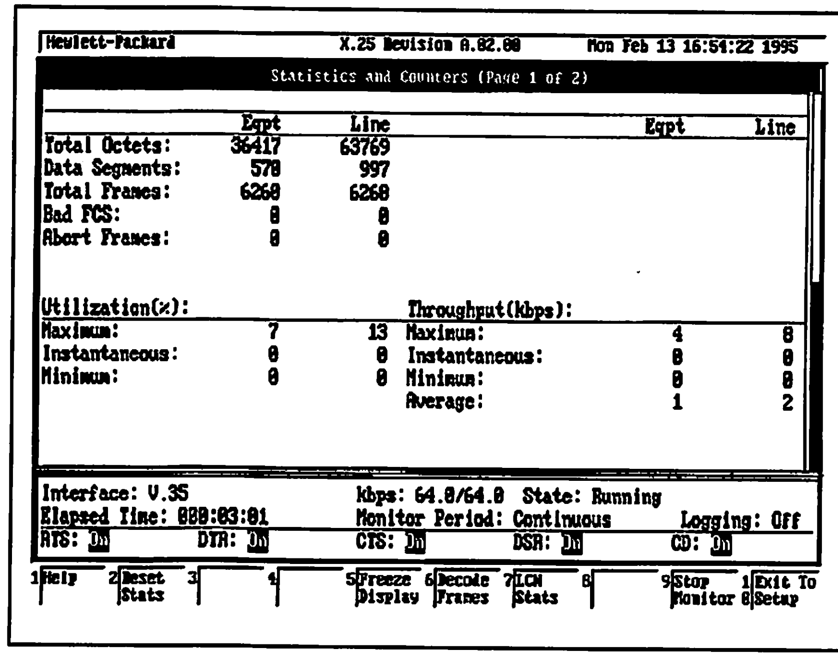


Figure 1-5: X.25 Statistics

All statistics measurements have a second page of information which shows the values of user defined hardware counters. Pressing the Down Arrow or **PgDn** accesses the second page of statistics. Refer to chapter 4, "Monitoring," for more information on configuring statistics and decodes. Higher level protocols have specialized statistics (such as, X.25 LCN Statistics and Frame Relay DLCI Statistics).

Hewlett-Packard provides additional statistics with the HP Internet Reporter (an optional software package). The HP Internet Reporter is a management tool that provides a broad collection of capability to develop reports and a network base line. It is especially useful in the verification of network health and performance and for capacity planning. Contact your Hewlett-Packard sales representative for more information.

Figure 1-6 shows a sample T1 BERT measurement. The upper portion of the screen shows BERT statistics and the bottom of the screen shows the interface and test status. Refer to chapter 6, "BERT Analyzer," for more information on BERT measurements.

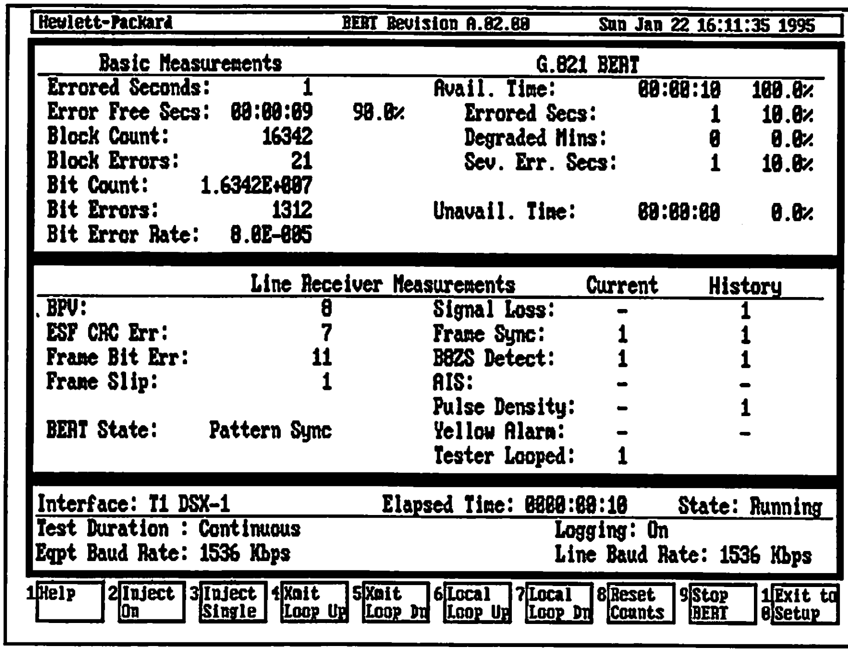


Figure 1-6: T1 BERT Measurement

Internet Advisor Software Revision

Every Internet Advisor software module automatically indicates its revision level at the top of its display. To verify the operating system software and firmware revisions, enter the following command from a DOS prompt:

```
TYPE C:\HPTOOLS\VERSION.TXT
```

Summary

Use the following basic procedure to run all tests from the Internet Advisor:

1. Select the test from Toolkit.

   Refer to Appendix B, "Supplied Tests," for a description of Hewlett-Packard provided tests. These are especially beneficial for the LAN over WAN tests where there are a number of defined counters provided.

2. Configure the interface parameters if necessary.

3. Configure any additional test parameters required, such as Decodes or BERT patterns.

4. Press **F9** (Start Test) to start the test.

After you stop a test there are utilities available to view, record and print the information obtained. You can configure and save tests for your environment and then recall them for later use.

2

Connecting To The Network

Introduction

This chapter describes the methods of connecting the Internet Advisor to network devices through the V-Series, T1, and E1 interfaces.

V-Series Connections

V-Series interfaces provide standardized interconnection of Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE). DTEs are usually computers, PCs, printers and CRTs and DCEs are usually modems, DSUs, TAs, and NTs (ISDN Terminal Adapters and Network Terminators). DTEs are the sources or destinations of binary data. DCEs are the devices which facilitate long-haul connections between DTEs.

V-Series recommendations specify that DCE devices should have a female connector. This is almost always the case. DTE devices are specified to have a male connector, but many times they also use the more rugged female connector internally and depend upon a male to male cable to correctly carry the data and control signals to the DCE. You should keep this in mind while making connections described in this chapter, because the specified connectors might change gender due to the particular usage.

Figures 2-1 through 2-4 show Internet Advisor connections to a V-Series interface. You can connect the Internet Advisor at either the DCE or DTE end of the V-Series link. Since each of the data, control, and timing signals have their own conductor in a V-Series interface, the connection to the Internet Advisor is always "straight through."

There are four main ways of connecting the Internet Advisor to a circuit to be tested. Figures 2-1 and 2-2 show the connection of a V-Series interface to a circuit for monitoring. You use a Y-cable (a cable with one female and two male

connectors) to connect the Internet Advisor for monitoring. After connecting for monitoring, the Internet Advisor can collect and interpret data as well as compile statistics.

The Internet Advisor passively monitors the circuit under test. To passively monitor is to monitor without transmitting data or exercising control over the interface.

Figure 2-1 shows the connection of the Internet Advisor between a DTE and DCE. You make this connection by momentarily interrupting the circuit to install the female and male Y-cable connectors, as shown. This can cause an interruption in service. The other male connector goes to the appropriate test port of the Internet Advisor.

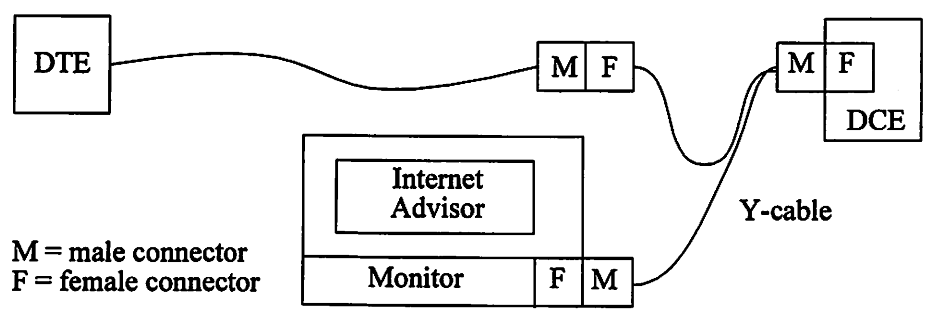


Figure 2-1: V-Series Passive Monitor In-Line Connection

Figure 2-2 shows a test panel as part of the test circuit system. The test panel can be accessed for monitoring without interrupting the service. One male connector, of the Y-cable, goes to the rear port on the Internet Advisor (V-Series, T1, or E1), the other male connector goes to the monitor port on the test panel, and the female connector is not used. Either Internet Advisor port could be used but care must be taken when using the front port because the switches might be opened.

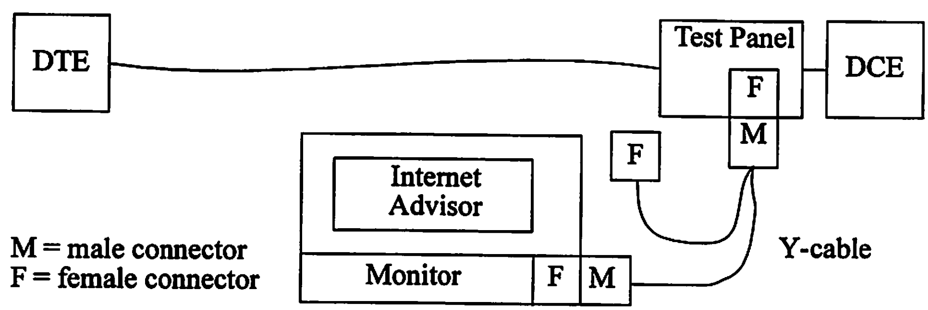


Figure 2-2: V-Series Passive Monitor Test Panel Connection

Figures 2-3 and 2-4 show the connection of a V-Series interface to a circuit for simulating or for performing BERT. In these cases, the Internet Advisor supplies (or transmits) data and control signals to the interface.

Figure 2-3 shows the connection of the Internet Advisor to a DTE (simulating DCE data traffic sending data to a DTE.) You can configure the Internet Advisor to simulate a DCE to provide stimulus for testing DTEs. You can automatically configure the Internet Advisor for this by loading one of the supplied tests that simulate test calls to a terminal device from X.25 or Frame Relay Networks. Refer to Appendix B, "Supplied Tests," for more information on HP preconfigured tests.

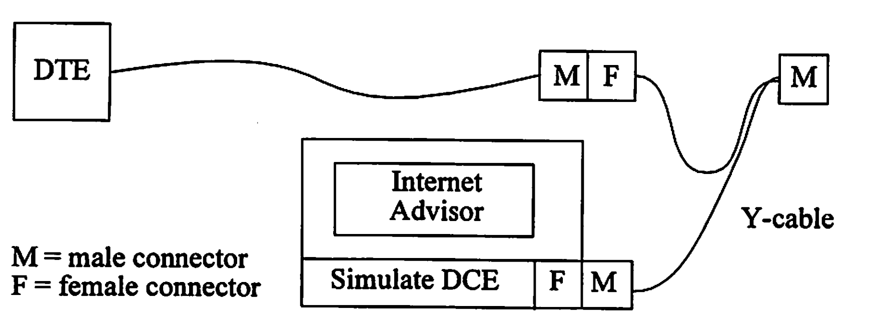


Figure 2-3: V-Series Active Connection To Test Terminal Device

CAUTION

When using a Y-cable to attach the Internet Advisor to a DTE, take care to keep the pins of the unused male connector from inadvertently making contact with any metal object. This is especially true for the V.35 male connector. The signal levels are very low energy, and therefore not dangerous, but accidental short circuits can cause improper operation of the DTE and unreliable data collection by the Internet Advisor.

Figure 2-4 shows the connection of the Internet Advisor to a DCE (simulating DTE data traffic sending data to the DCE.) In this case, the Internet Advisor is configured to simulate a DTE. When you connect the Internet Advisor to a DCE, the Internet Advisor emulates a DTE sending traffic to the DCE to test the entire link or network. You can automatically configure the Internet Advisor for this by loading one of the supplied tests that places an X.25 call or sends Frame Relay data. Refer to Appendix B, "Supplied Tests," for more information on HP preconfigured tests.

This is also the most common method of connecting and executing BERT through a V-Series interface.

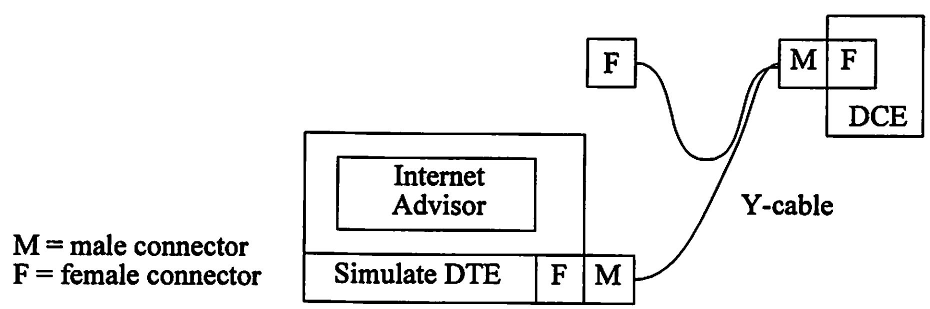


Figure 2-4: V-Series Active Connection To Test DCE and Link

T1 Connections

T1 signal nomenclature often causes confusion. Understanding the naming convention is essential to correctly connecting to a T1 network.

T1 consists of two electrical signals, Line and Equipment. Line is the signal from the Central Office (CO) to the Customer Premises (CP). Equipment is the signal from the Customer Premises to the Central Office. Between the CP and CO is a Channel Service Unit (CSU) which has access points and test points.

Figure 2-5 shows a CSU, which conforms to the latest industry recommendations, where every access point has a corresponding test point (also called a monitor point.) The signals available at monitor points are attenuated and isolated versions of the signals at the access points. Line Out and Equipment In are receiver inputs on CSUs.

On older CSUs with only two monitor points, the Line Monitor is usually connected to Line Out and the Equipment Monitor is usually connected to Equipment In.

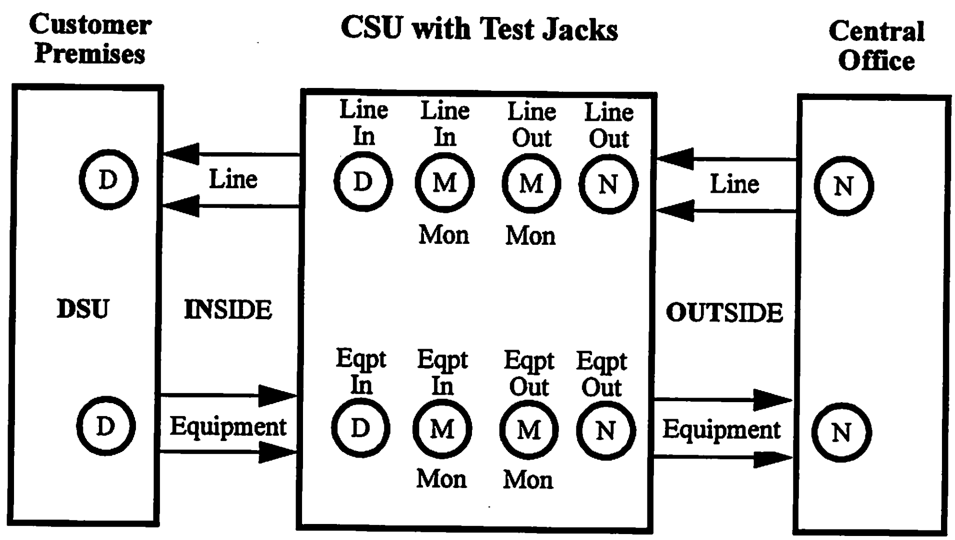


Figure 2-5: T1 CSU Connection Points

In telephone company terms, the CSU is the interface between INSIDE (the customer premise) and OUTSIDE (lines from CO). Devices INSIDE are on the Customer Premises. OUTSIDE refers to the lines to the Central Office. Some confusion regarding test connections occurs because of the names used for the CSU access. The following are the names used for the CSU access ports:

Line Out	The OUTSIDE Line signal from CO to CSU. The CSU receives the Line signal on this port.
Line In	The INSIDE Line signal from the CSU to the Data Service Unit (DSU) or other customer equipment. The CSU transmits the Line signal to the customer equipment through this port.
Equipment In	The INSIDE Equipment signal from the DSU or other customer equipment to the CSU. The CSU receives the Equipment signal through this port.
Equipment Out	The OUTSIDE Equipment signal from the CSU to the CO. The CSU transmits the Equipment signal through this port.

All CSUs have a signal regenerator between Line Out and Line In. Some can regenerate the signal between Equipment In and Equipment Out, but most often this is just a "pass through."

On the Internet Advisor configure the Interface Setup Menu's **Interface Type** field to T1 DSX-1 for the proper signal level and conditioning for everything INSIDE, the "D" access points in the Figure 2-5. Configure the Interface Setup Menu's **Interface Type** field to T1 Network Interface for the proper signal level and conditioning for signals arriving through a length of OUTSIDE cable, the "N" access points. Configure the Interface Setup Menu's **Receiver Mode** to Monitor Jack when attached to "M" test points.

There is an INSIDE and an OUTSIDE in a Central Office also. The device which connects the CO to the OUTSIDE is called a Line Terminating Unit (LTU). It has much the same function as a CSU. On the Internet Advisor configure the Interface Setup Menu's **Interface Type** field to T1 DSX-1 for the proper levels when testing INSIDE a CO and configure it to T1 Network Interface for the proper levels when testing OUTSIDE a CO.

NOTE

Due to the variety of T1 connections possible with the Internet Advisor, its signal port nomenclature is different from that of a CSU. The Internet Advisor uses the LINE IN port to receive the signal from Line and displays Line data and statistics, and uses the EQPT IN port to receive the Equipment signal and reports Equipment data and statistics.

The T1 Internet Advisor has two independent transmitters. When simulating/emulating Line, the Line transmitter delivers tests signals and non-dropped Line channels to LINE OUT. Also, when simulating/emulating Line, the EQPT IN signal is received by the Equipment receiver and retransmitted by the Equipment transmitter on EQPT OUT. This is referred to as a "Thru" connection.

When using the Internet Advisor for simulating/emulating Equipment, the Equipment transmitter delivers tests signals and non-dropped Equipment channels to EQUIP OUT. Also, when simulating/emulating Equipment, the LINE IN signal is received by the Line receiver and retransmitted by the Line transmitter on LINE OUT. This is referred to as a "Thru" connection.

One **Receiver Mode** for the Internet Advisor is Thru/Drop & Insert. When using the Internet Advisor for simulating/emulating Line, the Line receiver delivers its received bit stream to the Line transmitter to be output on LINE OUT, refer to Figure 2-6. Those channels not selected, in the **Data Channel** field, are retransmitted. The channels selected, in the **Data Channel** field, are "dropped" from the receiver's bit stream and the simulation/emulation signal is applied in their place. Also, when simulating/emulating Line, EQPT IN is received and regenerated as EQPT OUT in a "pass-through" mode (that is, no Drop & Insert.)

When using the Internet Advisor for simulating/emulating Equipment, the Equipment receiver delivers its received bit stream to the Equipment transmitter to be output on EQPT OUT. Those channels NOT selected, in **Data Channel** field, are retransmitted. The channels selected, in **Data Channel** field, are "dropped" from the receiver's bit stream and the simulation/emulation signal is applied to the Equipment transmitter in their place. Also, when simulating/emulating Equipment, LINE IN is received and regenerated as LINE OUT in a "pass-through" mode (that is, no Drop & Insert.)

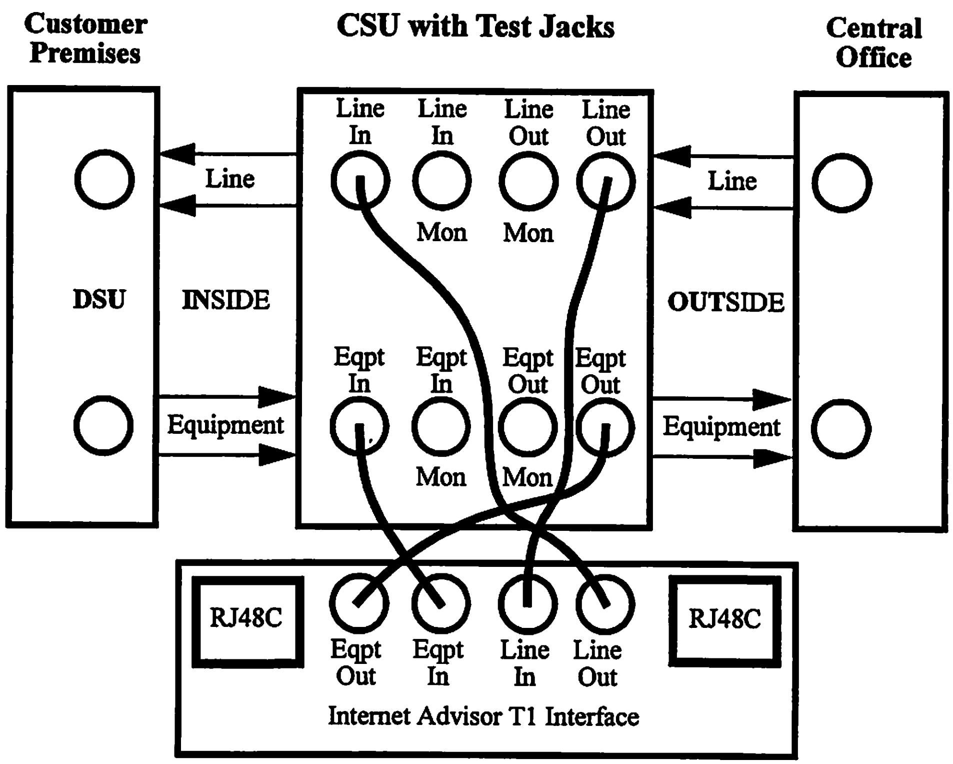


Figure 2-6: T1 "Drop & Insert" Connection

If the CSU incorporates RJ48C Smart Jacks instead of WECO 310 or Bantam jacks, you can connect the left hand RJ48C Internet Advisor jack (designated TO LINE) to the Central Office side of the CSU. The right hand RJ48C jack (designated TO EQPT) connects to the Customer Premises side of the CSU.

Tables 2-1 through 2-5 show various tests and associated configurations and test points connections for the Internet Advisor operating as a T1 tester. Figure 2-5 shows the CSU connection points.

Table 2-1: T1 Test Connections at CSU Jack Field

To Run the Listed Test:	Set the Interface Type To:	Set the Run Mode or Emulate To:	Set the Receiver Mode To:	Connect the Listed Internet Advisor Connector:	To the Listed CSU Test Jack:
Monitor data and statistics	Network	Monitor	Monitor Jack	LINE IN EQPT IN	Line Mon Eqpt Mon
Sim&BERT CSU to CO	Network	Equipment	Terminated	EQPT OUT LINE IN	Eqpt Out Line Out
Sim&BERT CSU to DSU	DSX-1	Line	Terminated	LINE OUT EQPT IN	Line In Eqpt In
Sim&BERT CSU to DSU (Fractional Drop & Insrt)	DSX-1 Selected channels	Line	Thru/Drop & Insert	LINE OUT LINE IN EQPT IN EQPT OUT	Line In Line Out Eqpt In Eqpt Out
Emulate CSU	Network Insert 0 (zero) channels	Line	Thru/Drop & Insert	LINE OUT LINE IN EQPT IN EQPT OUT	Line In Line Out Eqpt In Eqpt Out

NOTE

Most CSU test points give access to the twisted-pair wiring that go to and come from the CSU. In other words, the Line Out test jack connects to the wires coming from the central office. Some of the older CSUs have test jacks that give access to the CSU itself by connecting the Line Out test jack to the input of the CSU Line receiver. Check your CSU service documentation to understand how your CSU test ports are configured.

Table 2-2: T1 Connections at a Jack Field Between CSU and DSU

To Run the Listed Test:	Set the Interface Type To:	Set the Run Mode or Emulate To:	Set the Receiver Mode To:	Connect the Listed Internet Advisor Connector:	To the Listed Test Jack:
Monitor at Monitor Jack	DSX-1	Monitor	Monitor	LINE IN EQPT IN	Line Mon Eqpt Mon
Monitor data and statistics without Monitor Jack	DSX-1	Monitor	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From CSU To DSU From DSU To CSU
Sim&BERT Thru CSU	DSX-1	Equipment	Terminated	EQPT OUT LINE IN	To CSU From CSU
Sim&BERT Thru CSU (Fractional Drop & Insrt)	DSX-1 Selected Channels	Equipment	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From CSU To DSU From DSU To CSU
Sim&BERT Thru DSU	DSX-1	Line	Terminated	LINE OUT EQPT IN	To DSU From DSU
Sim&BERT Thru DSU (Fractional Drop & Insrt)	DSX-1 Selected Channels	Line	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From CSU To DSU From DSU To CSU

The term DSU refers generically to all Customer Premises Equipment, such as; Channel Banks, Multiplexers, and Type 2 ISDN Primary Rate Network Terminators. CSU generically includes Type 1 ISDN Primary Rate Network Terminators.

NOTE

If a T1 link is experiencing difficulties due to inadequate signal levels, the insertion of the Internet Advisor configured to perform a Drop & Insert test might correct the signal levels enough to temporarily restore the link.

Table 2-3: T1 Connections at a Jack Field Between CSU and CO

To Run the Listed Test:	Set the Interface Type To:	Set the Run Mode or Emulate To:	Set the Receiver Mode To:	Connect the Listed Internet Advisor Connector:	To the Listed Test Jack:
Monitor at Monitor Jack	Network	Monitor	Monitor	LINE IN EQPT IN	Line Mon Eqpt Mon
Monitor data and statistics without Monitor Jack	Network	Monitor	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From CO To CSU From CSU To CO
Sim&BERT To/Thru CO	Network	Equipment	Terminated	EQPT OUT LINE IN	To CO From CO
Sim&BERT To/Thru CO (Fractional Drop & Insrt)	Network Selected channels	Equipment	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From CO To CSU From CSU To CO
Sim&BERT Thru CSU	Network	Line	Terminated	LINE OUT EQPT IN	To CSU From CSU
Sim&BERT Thru CSU (Fractional Drop & Insrt)	Network Selected channels	Line	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From CO To CSU From CSU To CO

Table 2-4: Connections With No Jack Field -- Inside

To Run the Listed Test:	Set the Interface Type To:	Set the Run Mode To:	Set the Receiver Mode To:	Connect the Listed Internet Advisor Connector:	To the Listed Test Jack:
Monitor Clip leads	DSX-1	Monitor	Bridged	LINE IN EQPT IN	Line Pair Eqpt Pair

Table 2-5: Connections With No Jack Field -- Outside

To Run the Listed Test:	Set the Interface Type To:	Set the Run Mode To:	Set the Receiver Mode To:	Connect the Listed Internet Advisor Connector:	To the Listed Test Jack:
Monitor Clip leads	Network	Monitor	Bridged	LINE IN EQPT IN	Line Pair Eqpt Pair

E1 Connections

E1 signal nomenclature often causes confusion. Understanding the naming convention is essential to correctly connecting to a E1 network.

E1 consists of two electrical signals, one from the Exchange to the Customer Premises (CP) and the other from the CP to the Exchange. From the Internet Advisor's perspective, the signal from the Exchange to the CP is the Line signal and the signal from the CP to the Exchange is the Equipment signal. Between the CP and Exchange is the Line Terminating Equipment (LTE). The LTE has access points and test points. LTEs provide signal regeneration of the Line and Equipment signals between the CP and Exchange.

Figure 2-7 shows an LTE in which every access point has a corresponding test point (also called a monitor point.) The signals available at monitor points are attenuated and isolated versions of the signals at the access points. You can configure the Internet Advisor's Interface Setup Menu **Receiver Mode** field to Monitor Jack -20 dB or Monitor Jack -30 dB as required.

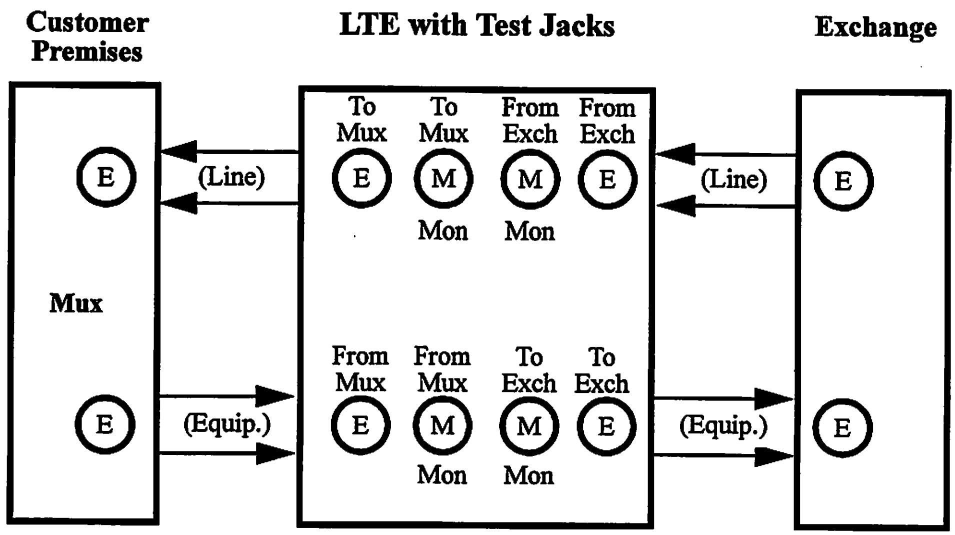


Figure 2-7: E1 LTE Connection Points

The E1 Internet Advisor has two independent transmitters. When simulating/emulating Line, the Line transmitter delivers tests signals and non-dropped Line channels to LINE OUT. Also, when simulating/emulating Line, the EQPT IN signal is received by the Equipment receiver and retransmitted by the Equipment transmitter on EQPT OUT. This is referred to as a "Thru" connection.

When using the Internet Advisor for simulating/emulating Equipment, the Equipment transmitter delivers tests signals and non-dropped Equipment channels to EQPT OUT. Also, when simulating/emulating Equipment, the LINE IN signal is received by the Line receiver and retransmitted by the Line transmitter on LINE OUT. This is referred to as a "Thru" connection.

Configure the Internet Advisor's Interface Setup Menu **Receiver Mode** field to Monitor Jack when connecting to the LTE monitor ports, which are labeled with an "M". You can only monitor when using ports labeled with an "M". All other LTE ports are labeled with an "E", which indicate that a full amplitude E1 signal is present. Ports labeled with an "E" can be used for simulating as well as monitoring.

One **Receiver Mode** for the Internet Advisor is **Thru/Drop & Insert**. When using the Internet Advisor for simulating/emulating Line, the Line receiver delivers its received bit stream to the Line transmitter to be output on LINE OUT refer to Figure 2-8. Those channels not selected, in the **Data Channel** field, are retransmitted. The channels selected, in the **Data Channel** field, are "dropped" from the receiver's bit stream and the simulation/emulation signal is applied in their place. Also, when simulating/emulating Line, EQPT IN is received and regenerated as EQPT OUT in a "pass-through" mode (that is, no Drop & Insert.)

When simulating/emulating Equipment, the Equipment receiver delivers its received bit stream to the Equipment transmitter to be output on EQPT OUT. Those channels NOT selected, in the **Data Channel** field, are retransmitted. The channels selected, in **Data Channel** field, are "dropped" from the receiver's bit stream and the simulation/emulation signal is applied to the Equipment transmitter in their place. Also, when simulating/emulating Equipment, LINE IN is received and regenerated as LINE OUT in a "pass-through" mode (that is, no Drop & Insert.)

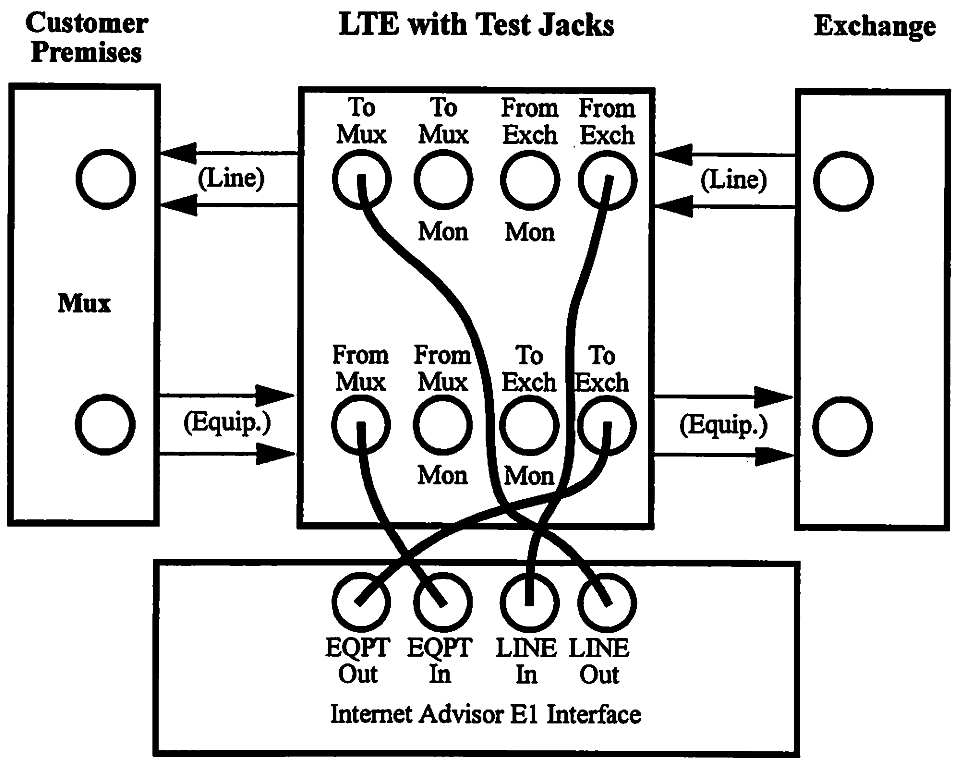


Figure 2-8: E1 "Drop & Insert" Connection

Tables 2-6 through 2-9 show various tests and associated configurations and test points connections for the Internet Advisor operating as an E1 tester. Figure 2-7 shows LTE connection points.

Table 2-6: E1 Test Connections at LTE Jack Field

To Run the Listed Test:	Set the Interface Type To:	Set the Run Mode or Emulate To:	Set the Receiver Mode To:	Connect the Listed Internet Advisor Connector:	To the Listed LTE Test Jack:
Monitor data and statistics	CEPT E1	Monitor	Monitor Jack	LINE IN EQPT IN	Line Mon Eqpt Mon
Sim&BERT LTE to Exch.	CEPT E1	Equipment	Terminated	EQPT OUT LINE IN	To Exch. From Exch
Sim&BERT LTE to Mux	CEPT E1	Line	Terminated	LINE OUT EQPT IN	To Mux From Mux
Sim&BERT LTE to Mux (Fractional Drop & Insrt)	CEPT E1 Selected channels	Line	Thru/Drop & Insert	LINE OUT LINE IN EQPT IN EQPT OUT	To Mux From Exch From Mux To Exch.
Emulate LTE	CEPT E1 Insert 0 (zero) channels	Line	Thru/Drop & Insert	LINE OUT LINE IN EQPT IN EQPT OUT	To Mux From Exch From Mux To Exch.

The term Mux refers generically to all Customer Premises Equipment, such as; Channel Banks, Multiplexers, and Type 2 ISDN Primary Rate Network Terminators. LTE generically includes Type 1 ISDN Primary Rate Network Terminators.

Table 2-7: E1 Connections at a Jack Field Between LTE and Mux

To Run the Listed Test:	Set the Interface Type To:	Set the Run Mode or Emulate To:	Set the Receiver Mode To:	Connect the Listed Internet Advisor Connector:	To the Listed Test Jack:
Monitor at Monitor Jack	CEPT E1	Monitor	Monitor	LINE IN EQPT IN	Line Mon Eqpt Mon
Monitor data and statistics without Monitor Jack	CEPT E1	Monitor	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From LTE To Mux From Mux To LTE
Sim&BERT Thru LTE	CEPT E1	Equipment	Terminated	EQPT OUT LINE IN	To LTE From LTE
Sim&BERT Thru Mux (Fractional Drop & Insrt)	CEPT E1 Selected Channels	Equipment	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From LTE To Mux From Mux To LTE
Sim&BERT To Mux	CEPT E1	Line	Terminated	LINE OUT EQPT IN	To Mux From Mux
Sim&BERT To Mux (Fractional Drop & Insrt)	CEPT E1 Selected Channels	Line	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From LTE To Mux From Mux To LTE

NOTE

If an E1 link is experiencing difficulties due to inadequate signal levels, the insertion of the Internet Advisor configured to perform a Drop & Insert test might correct the signal levels enough to temporarily restore the link.

Table 2-8: E1 Connections at a Jack Field Between LTE and Exchange

To Run the Listed Test:	Set the Interface Type To:	Set the Run Mode or Emulate To:	Set the Receiver Mode To:	Connect the Listed Internet Advisor Connector:	To the Listed Test Jack:
Monitor at Monitor Jack	CEPT E1	Monitor	Monitor	LINE IN EQPT IN	Line Mon Eqpt Mon
Monitor data and statistics without Monitor Jack	CEPT E1	Monitor	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From Exch To LTE From LTE To Exch.
Sim&BERT Thru Exch.	CEPT E1	Equipment	Terminated	EQPT OUT LINE IN	To Exch. From Exch
Sim&BERT Thru Exch. (Fractional Drop & Insrt)	CEPT E1 Selected channels	Equipment	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From Exch To LTE From LTE To Exch.
Sim&BERT To LTE	CEPT E1	Line	Terminated	LINE OUT EQPT IN	To LTE From LTE
Sim&BERT To LTE (Fractional Drop & Insrt)	CEPT E1 Selected channels	Line	Thru/Drop & Insert	LINE IN LINE OUT EQPT IN EQPT OUT	From Exch To LTE From LTE To Exch.

Table 2-9: E1 Connections With No Jack Field

To Run the Listed Test:	Set the Interface Type To:	Set the Run Mode To:	Set the Receiver Mode To:	Connect the Listed Internet Advisor Connector:	To the Listed Test Jack:
Monitor Clip leads	CEPT E1	Monitor	Bridged	LINE IN EQPT IN	Line Pair Eqpt Pair

3

Configuring the Internet Advisor

The Internet Advisor implements many of its capabilities in specialized hardware that serves as a data gathering "front-end" for the rest of the system. Several portions of this "front-end" must be configured prior to running a test. This chapter covers the following configuration topics:

- Configuring the T1, E1, and V-series interfaces using the Interface Setup Menu
- Autoconfiguring the T1 and E1 interfaces
- Loading and storing configurations
- Creating and configuring filters and/or counters for Statistics measurements
- Establishing the general run-time characteristics of the Internet Advisor, which include:
  - Capture Buffer configuration
  - Test duration
  - Statistics logging

Configuring Interfaces

When you select some of the Internet Advisor's tests (for example, the generic tests described in Appendix B "Supplied Tests"), the Interface Setup Menu is displayed first so that you can configure the fields in the Interface Setup Menu to match the parameters of the network you are going to test. When you select other Internet Advisor tests (for example, some of the preconfigured tests described in Appendix B "Supplied Tests), the selected test starts running immediately. In these tests, **F10** is labeled Exit to Setup, and pressing it stops the test and opens the Interface Setup Menu.

Although they appear similar, the T1, E1, and V-Series Interface Setup Menus are subtly different. Each is described separately in the sections that follow this section.

In any Interface Setup Menu, these are the available softkeys:

F1 (Help) — Opens the Internet Advisor's help system, displaying help on the Interface Setup Menu.

F2 (Auto Configure) — Automatically configures T1 and E1 interfaces with the correct framing and line coding. Establishes the receiver mode based on signal levels. Autoconfigure requires normal traffic to be present on the link. This is due to the fact that test patterns, particularly all ones or alternating 1s and 0s, do not cause B8ZS patterns on T1 or HDB3 patterns on E1. This makes Autoconfigure assume that the link is not configured for B8ZS or HDB3. Autoconfigure does not attempt to identify time slot groupings.

There is no autoconfigure capability for the V-Series interfaces. Attempting to autoconfigure a V-Series interface produces the message "Cannot Autoconfigure while in V-Series."

F3 (Load Setups)	Invokes the mass storage system to load a previously stored setup file. Setup files have the extension .PDB. See "Mass Store Functions" in chapter 7, "The Toolkit User Interface," for more details about the Internet Advisor's file system.
F4 (Store Setups)	Invokes the mass storage system to store the current configuration of the filters and counters, the Interface Setup Menu, the Decode Configuration, and the Run Configuration Menu to a file .PDB file. See "Mass Store Functions" in chapter 7, "The Toolkit User Interface," for more details about the Internet Advisor's file system. Also refer to "Customizing Toolkit" in chapter 7 for details of adding your own tests to the Toolkit.
F5 (Filters Countrs)	Lets you create and modify the hardware filters/counters. See the "Filters and Counters" section of this chapter for more information.
F6 (Decode Frames)	Puts the Internet Advisor into data decoding mode. See chapter 4, "Monitoring," for more information.
F7 (Stats & Countrs)	Puts the Internet Advisor into the statistic presentation mode. See chapter 4, "Monitoring," for more information.
F8 (Simulate)	Puts the Internet Advisor into the simulate mode. See chapter 5, "Simulating," for more information.
F9 (Run Config)	Opens the Run Configuration Menu, which gives you control over the data capture buffer and statistics logging. See the "Run Configuration" section in this chapter for more information.
F10 (Exit to Toolkit)	Returns to Toolkit after asking if you wish to exit the application. If you have been simulating on a T1, E1, or V-Series link, you are asked if you wish to exit with the transmitter still on. This is a safety precaution to prevent inadvertently shutting down an established circuit.

Configuring the T1 Interface

The HP J2301A T1 Internet Advisor comes with the T1 system software loaded and the T1 interface module installed. With the T1 Internet Advisor, you can run T1, V-Series (V.24/RS-232, V.35, and V.36/RS-449), ISDN, and X.21 tests. Selecting a T1 test opens the T1 Interface Setup Menu. Page 1 of 3 of the T1 Interface Menu is shown in Figure 3-1.

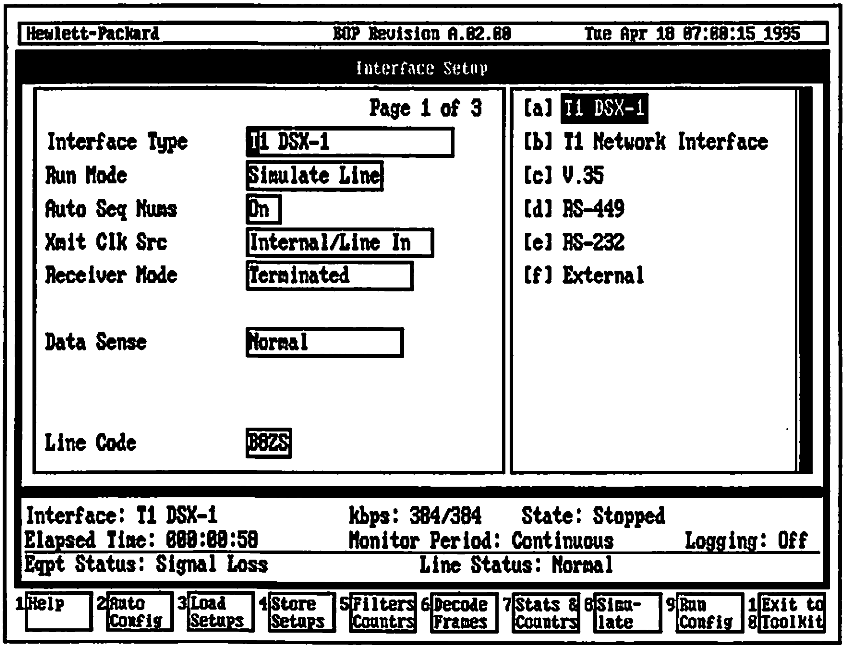


Figure 3-1: T1 Interface Setup Menu (Page 1 of 3)

These are the fields you can configure on page 1 of the T1 Interface Setup Menu:

Interface Type - This is the first field you should configure, because the selection you make for this field affects what other fields and choices are available. This field selects the Layer 1 interface. The following are your choices. To run a T1 test, choose either T1 DSX-1 or T1 Network Interface.

T1 DSX-1	T1 Interface at cross-connect signal levels (Inside).

T1 Network Interface	T1 Interface at line signal levels (Outside).
V.35	Use the built-in V.35 interface.
RS-449	Use the built-in RS-449 interface.
RS-232	Use the built-in RS-232 interface.
External	Use the external port. This could include X.21and ISDN interfaces.

NOTE

The rest of this section describes fields and choices that are available when the **Interface Type** field is set to T1 DSX-1 or T1 Network Interface. For information on the available choices when a V-series or External **Interface Type** is selected, refer to the section "Configuring the V-Series Interfaces."

Run Mode - This field determines whether the Internet Advisor is configured to monitor or to simulate. The choices for this field are:

Monitor	Capture data and statistics.
Simulate Line	Simulate the central office line signal.
Simulate Eqpt	Simulate the customer equipment.

Auto Seq Nums or **Auto Seq LCN** (for X.25) - If **Run Mode** is set to either Simulate Line or Simulate Eqpt, this field appears. The choices for this field are:

On	Automatically generates the correct N(S) and N(R) in applicable layer 2 protocols. Generates P(S) and P(R) in X.25. Recognizes the first LCN received as the active LCN for X.25 operation. Generates the correct Send Sequence Numbers and Receive Sequence Numbers for Frame Relay LMI Messages.
Off	No layer 2 or layer 3 automatic protocol help.

Xmit Clk src - If the **Run Mode** field is set to Simulate Line, then the following are your choices for the Transmit Clock source:

Recovered Eqpt	Clocking derived from the incoming Equipment signal.
Internal/Line In	Clocking derived from the incoming Line signal or, in its absence, self-generated independent clocking.

If **Run Mode** is set to Simulate Eqpt, then the following are your choices for **Xmit Clk src**:

Recovered Line	Clocking derived from the incoming Line signal.
Internal/Eqpt In	Clocking derived from the incoming Equipment signal or, in its absence, self-generated independent clocking.

Receiver Mode - The following are your choices:

Monitor Jack	Expect the lower amplitude, isolated T1 test point signal (increased receiver gain).
Terminated	Used when the Internet Advisor is the only device on the near end of the line.
Bridged	No termination, high impedance. Used when another device is attached at the near end of the line. Test cables should be less than 2 meters.
Thru/Drop & Insert	When monitoring, the selected channels are presented as the line and equipment signals for decoding and statistics displays. All channels are regenerated and passed through unaltered. When simulating Equipment, the EQPT In signal is regenerated as EQPT Out for the non-selected channels. The chosen test signals are inserted on the selected channels. LINE In is regenerated as LINE Out.

When simulating the Line, the LINE In signal is regenerated as LINE Out for the non-selected channels. The chosen test signals are inserted on the selected channels. EQPT In is regenerated as EQPT Out.

NOTE

The LINE In, LINE Out, EQPT In and EQPT Out ports are electrically isolated and transformer coupled in and out. When the Internet Advisor is turned off, LINE In is directly connected to LINE Out and EQPT In is directly connected to EQPT Out.

Data Sense - This field tells the Internet Advisor whether the data bits on the channel(s) being tested are inverted. A Mark is a signal pulse on a T1 line. A Space is a bit time with no pulse. The choices for this field are:

Normal	Tells the Internet Advisor that the data bits are not inverted; therefore, a Mark represents a binary 1.
Inverted	A Mark represents a binary 0.
NRZI - External	Non-Return to Zero Invert (on zeros), bit timing follows derived T1 timing. Successive Marks or Spaces represent binary 1. Changes from Mark to Space or from Space to Mark represent binary 0.

Line Code - The choices for this field are:

AMI	Alternate Mark Inversion. Usually the choice with D4 Framing. Common in existing 56 Kbps DDS type circuits.
B8ZS	Binary 8 Zeros Suppress. Used with more recent ESF T1 framing. Commonly used in 64 Kbps, fractional T1 and Primary Rate ISDN circuits.

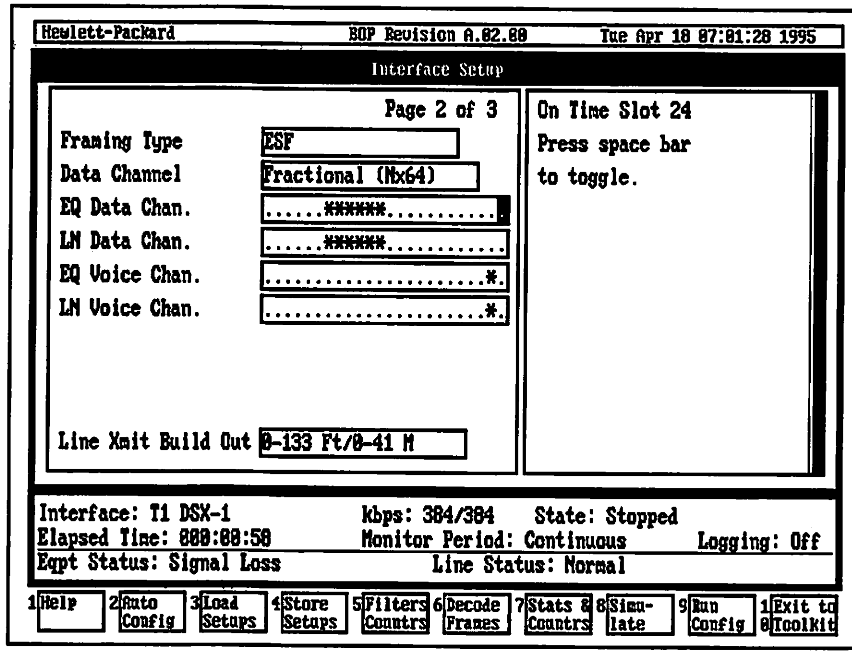


Figure 3-2: T1 Interface Setup Menu (Page 2 of 3)

Framing Type - The following are your choices:

ESF	Extended Super Frame (24 frames/ESF)
D4	Conventional Super Frame (12 frames/SF)
T1DM (DDS)	A.T.&T. DDS Framing using D4 and time slot 24
SLIC-96	Special version of D4 framing. Uses 4-D4 frames but changes some of the framing bits.
Unframed 1.544	No Framing

NOTE

Refer to Appendix D, "T1 and E1 Technology Overview," for an explanation of framing. The **Framing Type** field must be properly configured to match the links to be tested. If the configuration is not known, the T1 Auto Configure capability of the Internet Advisor can be used to determine proper parameters. Refer to the description of the **F2** (Auto Config) softkey in the earlier section "Configuring Interfaces."

Data Channel - If you select Unframed 1.544 Mbps for **Framing Type**, then there is no **Data Channel** choice to be made. If you select ESF or D4 for the **Framing Type**, then the following are your choices for **Data Channel**:

Full Frame (24x56)	All 24 timeslots are used. The least significant bit of each 8-bit timeslot is set to one.
Full Frame (24x64)	All 24 timeslots are used.
Fractional (Nx56)	One to 24 user-selected timeslots are used. The least significant bit of each selected 8-bit timeslot is set to one.
Fractional (Nx64)	One to 24 user-selected timeslots used.

If the **Run Mode** field is set to Monitor, these additional **Data Channel** choices are available:

DDS (1xDS0-A,1 User)	One user with a dedicated 64,000 bps time slot. The Internet Advisor multiplexes and de-multiplexes T1 time slots into the standard DDS subrates. Selecting this causes a new field, **User Chan Rate**, to appear in which you can specify a data rate of 2400, 4800, 9600, 19200 (with no error correction), 38400, or 56000 bps. DDS provides redundant error correction below 19,200 bps.

DDS (1xDS0-B,>1 User)	More than one user in the time slot. The Internet Advisor multiplexes and de-multiplexes T1 time slots into the standard DDS subrates. Selecting this causes three new fields, **User Chan Rate, Total User Channels**, and **User Chan Position**, to appear. In the **User Chan Rate** field, you can specify a data rate of 2400, 4800, 9600, 19200 (with no error correction), or 38400 bps. All users must have the same User Channel Rate. In the **Total User Channels** field, you can specify the total number of user channels. There may be up to 20 users at 2,400 bps, up to 10 at 4,800 bps, and no more than 5 at 9,600 bps. For rates higher than 9,600 bps, you must specify groupings of 9,600 bps subchannels in the **User Chan Position** field.
DDS (1x64,1 User)	One user operating at 64,000 bps.

EQ/LN Data and Voice Channels - Figure 3-2 shows additional Data and Voice Channel fields, which appear if you select a fractional or DDS choice for the **Data Channel** field. In Figure 3-2, 384 Kbps is the selected fractional rate (6 channels of 64 Kbps each).

Use the following fields to configure data and voice channels. Use the Left and Right Arrows to move the cursor to the desired time slot (as shown in the right panel of the screen) and press the Spacebar to select (mark with an asterisk) the channel.

EQ Data Chan	Equipment Data channel. Select which timeslots are to be used to make the fractional data rate for equipment data. Channels 7 through 12 are shown selected in Figure 3-2.
LN Data Chan	Line Data channel. Select which timeslots are to be used to make the fractional data rate for line data. Channels 7 through 12 are shown selected in Figure 3-2.

EQ Voice Chan	Select one of the channels as a voice channel. You can use this channel for voice communications or to monitor voice traffic. A voice handset can be attached on the right side of the Internet Advisor above the T1 interface module. The internal codec is set to mu-law encoding.
LN Voice Chan	Same as EQ Voice chan.

Line Xmit Build Out or **Eqpt Xmit Build Out** - If the **Run Mode** field is not set to Monitor, then this field appears and it is labeled according to the chosen simulation mode. **Xmit Build Out** adjusts the output signal either to compensate for a given length of standard network cable or by a number of deciBels (dB). It is important to set the signal level correctly. The distance from the test point to equipment and line devices should be known and calibrated. Choosing the proper **Xmit Build Out** choice ensures the correct signal levels at the inputs to equipment and line devices.

If the **Interface Type** field is set to T1 DSX-1, increasing the value of **Xmit Build Out** increases the signal. The choices for **Xmit Build Out** with T1 DSX-1 are:

0-133 Ft/0-41 M
133-266 Ft/41-81 M
266-399 Ft/81-122 M
399-533 Ft/122-162 M
533-655 Ft/162-183 M

If the **Interface Type** field is set to T1 Network Interface, increasing the value of **Xmit Build Out** attenuates the signal. The choices for **Xmit Build Out** with T1 Network Interface are:

0 dB	>3000 ft. to repeater. This is the only choice for **Line Xmit Build Out** when the **Run Mode** field is set to simulate the line.
7.5 dB	1500-3000 ft. to repeater.
15.0 dB	0-1500 ft. to repeater.

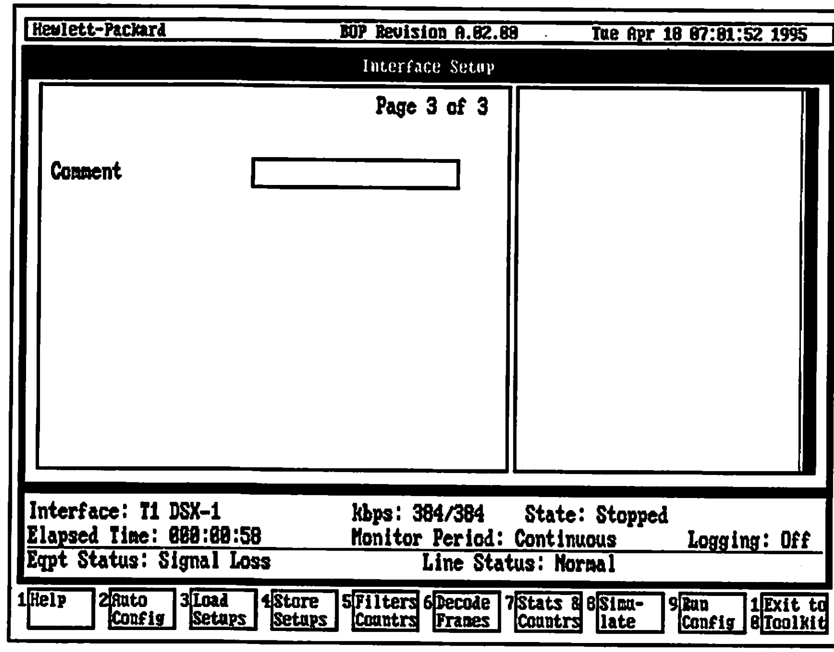


Figure 3-3: T1 Interface Setup Menu (Page 3 of 3)

Comment - This is the last field in the Interface Setup Menu. It lets you enter up to 40 characters to describe configuration choices you have made in the Interface Setup Menu. This comment and the configuration choices are saved to a file if you press **F4** (Store Setups). Refer to the description of the **F3** (Load Setups) and **F4** (Store Setups) softkeys in the earlier section "Configuring Interfaces" for more information.

Configuring the E1 Interface

The HP J2302A E1 Internet Advisor comes with the E1 system software loaded and the E1 interface module installed. With the E1 Internet Advisor, you can run E1, V-Series (V.24/RS-232, V.35, and V.36/RS-449), ISDN, and X.21 tests. Selecting an E1 test opens the E1 Interface Setup Menu. Page 1 of 3 of the E1 Interface Menu is shown in Figure 3-4.

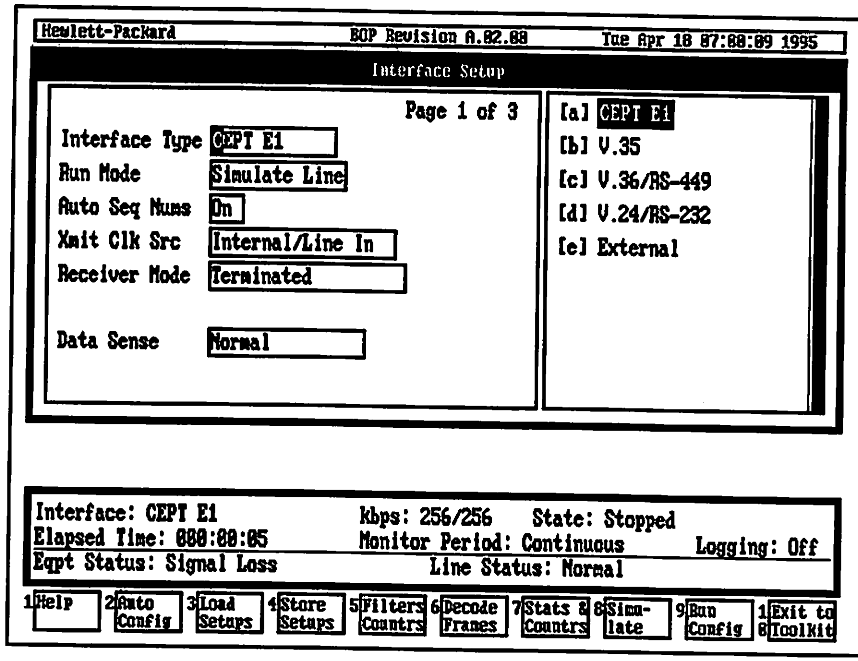


Figure 3-4: E1 Interface Setup Menu (Page 1 of 3)

These are the fields you can configure on page 1 of the E1 Interface Setup Menu:

Interface Type - This is the first field you should configure, because the selection you make for this field affects what other fields and choices are available. This field selects the Layer 1 interface. The following are your choices. To run an E1 test, choose CEPT E1.

CEPT E1	Use the installed E1 Interface.
V.35	Use the built-in V.35 interface.
V.36/RS-449	Use the built-in V.36/RS-449 interface. Also used in X.21 permanent circuits. Performing X.21 tests requires a special cable.
V.24/RS-232	Use the built-in V.24/RS-232 interface.

External	Use the external port. This could include X.21and ISDN interfaces.

NOTE

The rest of this section describes fields and choices that are available when the **Interface Type** field is set to CEPT E1. For information on the available choices when a V-series or External **Interface Type** is selected, refer to the section "Configuring the V-Series Interfaces."

Run Mode - This field determines whether the Internet Advisor is configured to monitor or to simulate. The choices for this field are:

Monitor	Capture data and statistics.
Simulate Line	Simulate the exchange (central office).
Simulate Eqpt	Simulate the customer equipment.

Auto Seq Nums or **Auto Seq LCN** (for X.25) - If **Run Mode** is set to either Simulate Line or Simulate Eqpt, this field appears. The choices for this field are:

On	Automatically generates the correct N(S) and N(R) in applicable layer 2 protocols. Generates P(S) and P(R) in X.25. Recognizes the first LCN received as the active LCN for X.25 operation. Generates the correct Send Sequence Numbers and Receive Sequence Numbers for Frame Relay LMI Messages.
Off	No layer 2 or layer 3 automatic protocol help.

Xmit Clk src - If the **Run Mode** field is set to Simulate Line, then the following are your choices for the Transmit Clock source:

Recovered Eqpt	Clocking derived from the incoming Equipment signal.
Internal/Line In	Clocking derived from the incoming Line signal or, in its absence, self-generated independent clocking.

If **Run Mode** is set to Simulate Eqpt, then the following are your choices for **Xmit Clk src:**

Recovered Line	Clocking derived from the incoming Line signal.
Internal/Eqpt In	Clocking derived from the incoming Equipment signal or, in its absence, self-generated independent clocking.

Receiver Mode - The following are your choices:

Monitor Jack -20dB	Expect the higher amplitude E1 test point signal.
Monitor Jack -30dB	Expect the lower amplitude E1 test point signal.
Terminated	Used when the Internet Advisor is the only device on the near end of the line.
Bridged	No termination, high impedance. Used when another device is on the near end of the line. Test cables should be less than 2 meters.
Thru/Drop & Insert	When monitoring, the selected channels are presented as the line and equipment signals for decoding and statistics displays. All channels are regenerated and passed through unaltered. When simulating Equipment, the EQPT In signal is regenerated as EQPT Out for the non-selected channels. The chosen test signals are inserted on the selected channels. LINE In is regenerated as LINE Out. When simulating the Line, the LINE In signal is regenerated as LINE Out for the non-selected channels. The chosen test signals are inserted on the selected channels. EQPT In is regenerated as EQPT Out.

EQ Data Chan	Equipment Data channel. Select which timeslots are to be used to make the fractional data rate for equipment data. Channels 5 through 8 are shown selected in Figure 3-5.
LN Data Chan	Line Data channel. Select which timeslots are to be used to make the fractional data rate for line data. Channels 5 through 8 are shown selected in Figure 3-5.
EQ Voice Chan	Select one of the channels as a voice channel. You can use this channel for voice communications or to monitor voice traffic. A voice handset can be attached on the right side of the Internet Advisor above the E1 interface module. The internal codec is set to A-law encoding.
LN Voice Chan	Same as EQ Voice chan.

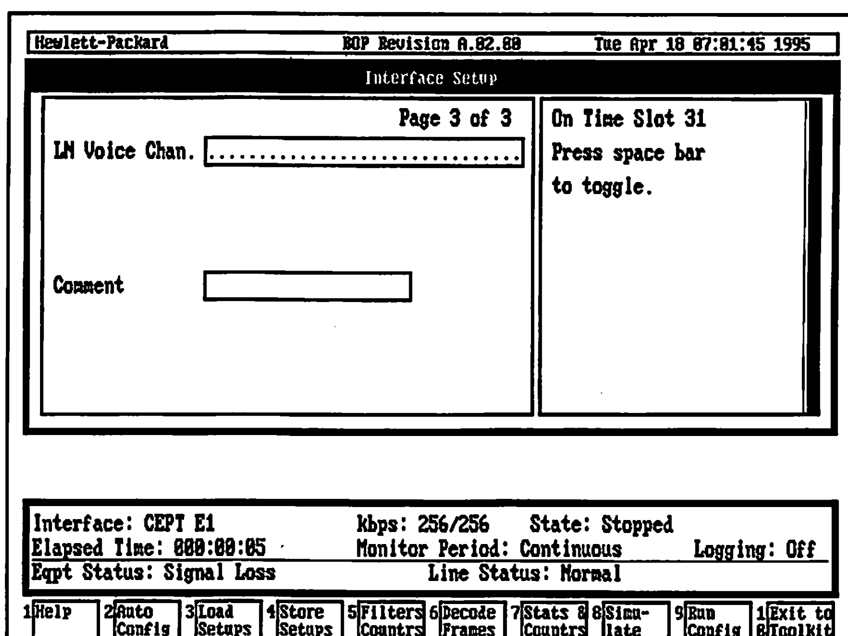


Figure 3-6: E1 Interface Setup Menu (Page 3 of 3)

Comment - This is the last field in the Interface Setup Menu. It lets you enter up to 40 characters to describe configuration choices you have made in the Interface Setup Menu. This comment and the configuration choices are saved to a file if you press **F4** (Store Setups). Refer to the description of the **F3** (Load Setups) and **F4** (Store Setups) softkeys in the earlier section "Configuring Interfaces" for more information.

Configuring the V-Series Interfaces

You can configure either T1 or E1 Internet Advisors to run V-Series (V.24/RS-232, V.35, and V.36/RS-449) or External (ISDN and X.21) tests. There are fewer parameters to configure when setting up V-Series or External interfaces. The following are the fields you can configure for V-series and External interfaces:

Interface Type - This is the first field you should configure, because the selection you make for this field affects what other fields and choices are available. To run a V-Series or External test, choose one of the following:

V.35	Use the built-in V.35 interface.
RS-449 (on a T1 unit) or V.36/RS-449 (on an E1 unit)	Use the built-in RS-449 interface.
RS-232 (on a T1 unit) or V.24/RS-232 (on an E1 unit)	Use the built-in RS-232 interface.
External	Use an external interface (for example, ISDN or X.21).

Figure 3-7 shows how page 1 of 3 of the Interface Setup Menu looks if you select V.35 for **Interface Type** on system configured with the T1 operating system. If you have an E1 operating system, the last field, **Rate**, appears as the only item on Page 2 of 3. The T1 operating system does not have a Page 2 of 3 for the V-Series interfaces.

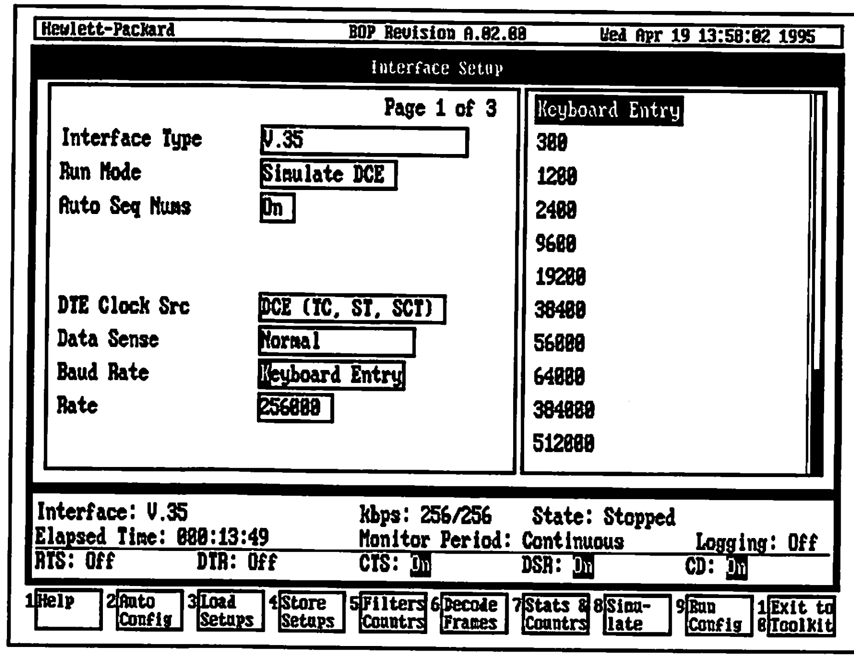


Figure 3-7: V-Series Interface Setup Menu (Page 1 of 3)

Once you have selected **Interface Type**, you can make selections for the following fields. These fields are common to all the V-series interfaces:

Run Mode - This field determines whether the Internet Advisor is configured to monitor or to simulate. The choices for this field are:

Monitor	Passively monitor both DCE and DTE traffic. If Monitor is chosen, there is no **Auto Seq Nums** field and no **Baud Rate** field.
Simulate DCE	Simulate Data Circuit-terminating Equipment.
Simulate DTE	Simulate Data Terminal Equipment.

Auto Seq Nums or **Auto Seq LCN** (for X.25) - If **Run Mode** is set to either Simulate DCE or Simulate DTE, this field appears. The choices for this field are:

On	Automatically generates the correct N(S) and N(R) in applicable layer 2 protocols. Generates P(S) and P(R) in X.25. Recognizes the first LCN received as the active LCN for X.25 operation. Generates the correct Send Sequence Numbers and Receive Sequence Numbers for Frame Relay LMI Messages.
Off	No layer 2 or layer 3 automatic protocol help.

DTE Clock Src - The V-Series specifications offer a choice for the clocking of transmitted data from Data Terminal Equipment when a simulate mode is chosen in the **Run Mode** field. The Internet Advisor must be configured to match the system clocking to properly detect and decode DTE data. The choices for this field are:

DTE (ETC, TT, SCE)	The terminal device is supplying its own clocking. This is not very common.
DCE (TC, ST, SCT)	The terminal device accepts clocking by the DCE. This is typical in most V-Series connections.

Data Sense - On V-series interfaces, Mark on a data line is the same state as Off on a control line. For example, the Mark condition on an RS-232 data signal is a negative voltage, and Space is a positive voltage. The choices for this field are:

Normal	A Mark represents a binary 1.
Inverted	A Mark represents a binary 0.
NRZI - External	Non-Return to Zero Invert (on zeros), bit timing is determined from the clocking signals present on the V-Series interface. Successive Marks or Spaces represent binary 1. Changes from Mark to Space or from Space to Mark represent binary 0.

Baud Rate - This field only appears when **Run Mode** is set to Simulate DCE, or when **Run Mode** is Simulate DTE and **DTE Clock Src** is DTE (ETC, TT, SCE). You can select from a list of standard rates, or you can enter the baud rate from the keyboard. The choices are:

Keyboard Entry	Selecting this, causes a new field, **Rate**, to appear in which you can enter any value between 50 bps and 2048 kbps.

NOTE

Rate appears on Page 1 of 3 for the T1 operating system, and it is the only entry on Page 2 of 3 for the E1 operating system. The T1 operating system has no Page 2 of 3. Use the Up Arrow to move from Page 3 of 3 back to Page 1 of 3.

300	Not normally a synchronous rate.
1200	Not normally a synchronous rate.
2400	Normally the lowest synchronous rate.
9600	Very common synchronous rate.
19200	Very common synchronous rate.
38400	Special applications as a synchronous rate.
56000	DDS time slot.
64000	ISDN "B" channel & normal T1/E1 single channel. Highest recommended RS-232 rate.
384000	Fractional T1/E1, 6 channels.
512000	Fractional T1/E1, 8 channels.
1024000	Fractional T1/E1, 16 channels.
1536000	Full T1 "Payload," fractional E1, 24 channels.
1984000	Full E1 "Payload," 31 channels.
2048000	Unframed E1.

Comment - For both the T1 and the E1 operating systems, this is the only field on Page 3 of 3 of the Interface Setup Menu. This field lets you enter up to 40 characters to describe configuration choices you have made in the Interface Setup Menu. This comment and the configuration choices are saved to a file if you press **F4** (Store Setups). Refer to the description of the **F3** (Load Setups) and **F4** (Store Setups) softkeys in the earlier section "Configuring Interfaces" for more information.

Filters and Counters

The Internet Advisor provides "front-end" filtering and match counting of incoming data. This filtering/counting is implemented in hardware, giving the Internet Advisor significant performance advantages over "software only" implementations. These filter/counters can also serve as specialized triggers to control data capture.

From the Interface Setup Menu, press **F5** (Filters Countrs) to open the screen that displays the current status of the filters/counters. An example is shown in Figure 3-8.

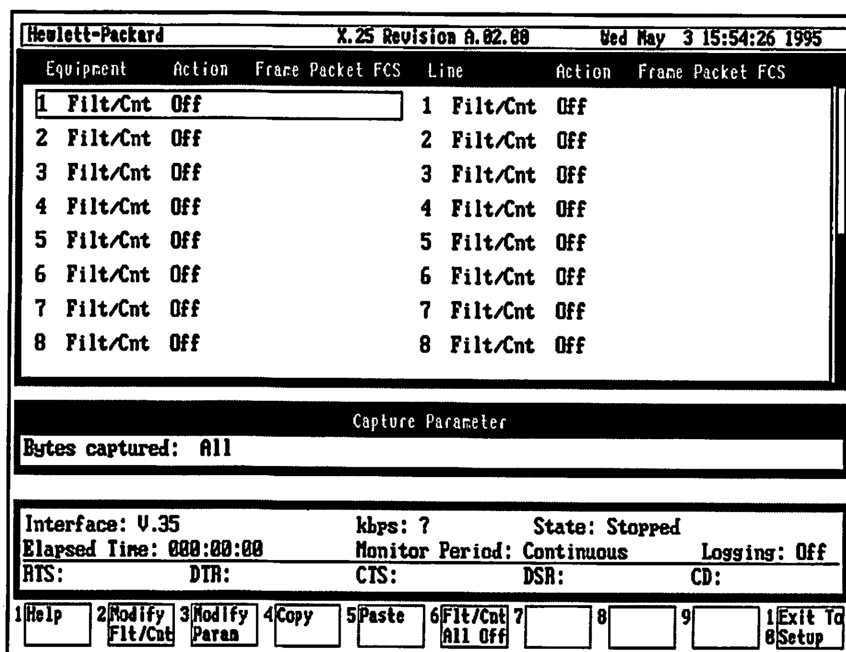


Figure 3-8: Filters and Counters Screen

There are eight combination filter/counters for the Equipment (DTE) side and eight for the Line (DCE) side. There are an additional eight counters without filtering capability for both the Equipment (DTE) side and the Line (DCE) side (which can be seen by pressing **PgDn**). In Internet Advisor tests which are not preconfigured (for example, in generic tests), the default labels for the first set of eight filter/counters are Filt/Cnt 1 through Filt/Cnt 8, and the default labels for the second set of eight filter/counters are Filt/Cnt 9 through Filt/Cnt 16. In tests that are preconfigured, the filter/counter labels reflect the function of the filter/counter. Figure 3-9 shows how the filter/counters are labeled in the preconfigured HDLC T1 Monitor test. They are configured as counters in this test. (Refer to Appendix B, "Supplied Tests," for information on generic and preconfigured tests.)

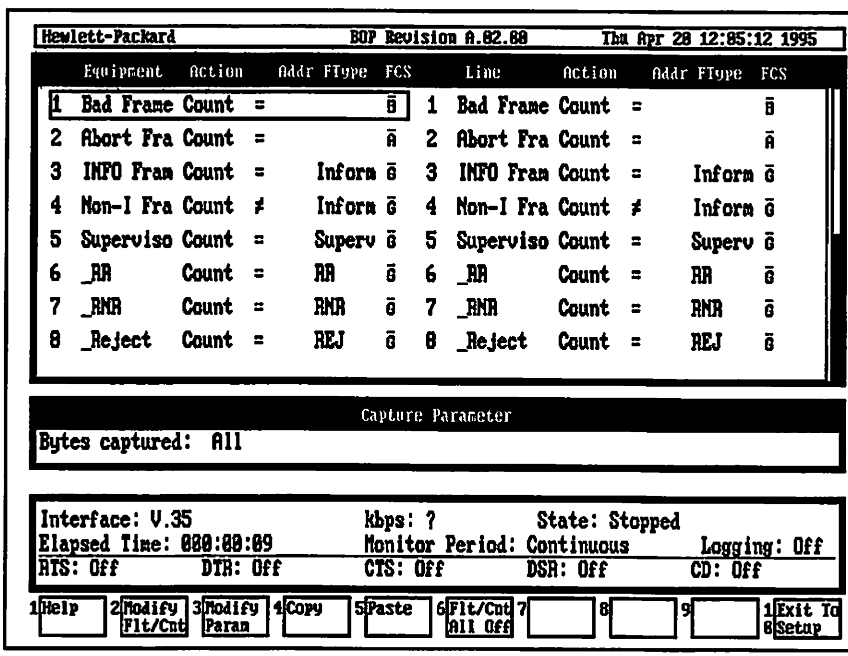


Figure 3-9: Preconfigured Filters and Counters

All the first eight filters on the Equipment side are logically "ORed" together, and all the first eight filters on the Line side are logically "ORed" together. That is, any given frame might satisfy the first filter OR the second OR the third, and so on.

The **Action** column describes what each filter/counter is to do. The **Addr** column shows a layer 2 address if one is specified. **FType** presents the mnemonic for the frametype. **FCS** is the type of frame check that the filter is configured to find: $\overline{G}$ for Good, $\overline{B}$ for Bad, $\overline{A}$ for Abort, and $\overline{X}$ for Don't Care.

These are the softkeys in the Filters and Counters screen:

F2 (Modify Flt/Cnt) — Pressing this opens the Modify Filter/Counter Menu in which you can modify filters and counters. Refer to the section "Modifying Filters and Counters" for more information.

F3 (Modify Param) — The function of this softkey is described in the procedure which follows these softkey descriptions.

F4 (Copy) — Pressing this makes a copy of the highlighted filter/counter.

F5 (Paste) — Pressing this pastes the copy to a highlighted filter/counter position.

F6 (Flt/Cnt All Off) — Pressing this sets all 32 filter/counters Off. You are asked to verify that you really want to turn off filters before it happens. After turning off all filters, if you want a filter on, it must be individually turned on in the Modify Filter/Counters Menu. Refer to the section "Modifying Filters and Counters" for more information.

F10 (Exit to Setup) — Pressing this returns you to the Interface Setup Menu.

The bottom part of the Filters and Counters screen is labeled Capture Parameter. In Figure 3-8, this part of the screen shows that all bytes will be captured. Many times, however, it is sufficient for troubleshooting purposes to capture just frame headers. Doing this allows more frames to be stored in the capture buffer. To control whether all bytes or only partial frames are captured, do the following:

1. Press **F3** (Modify Param). The Capture Parameter Menu opens, as shown in Figure 3-10.

2. In the **Bytes Captured** field, select All or Partial. If you select Partial, a new field, **Number of Bytes Per Frame**, appears in which you must specify the number of bytes. The minimum number of bytes you can specify is 5, the maximum is 9,204. If you select Partial, frame headers are captured and the length and FCS information is also stored.

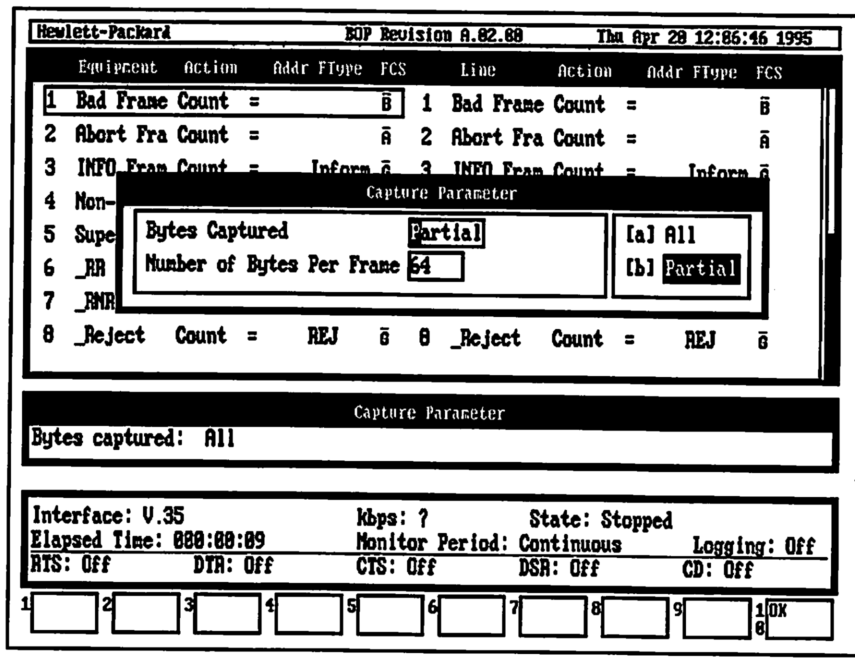


Figure 3-10: Capture Parameter Menu

NOTE

The counters/filters are implemented in programmable hardware. In the preconfigured tests, they are set to count specific data patterns based on standard usage. Non-standard variations in protocols or usage may defeat a counter/filter's recognition ability.

Modifying Filters and Counters

1. To modify a filter/counter, in the Filters and Counters screen, use the arrow keys to highlight the filter/counter you want to modify, and then press **F2** (Modify Flt/Cnt).

The Modify Filter/Counter Menu is opened. If the filter/counter you chose to modify is currently off, the Modify Filter/Counter Menu only contains the **Label** field and the **Action** field. If the filter/counter you chose to modify is not currently off, the Modify Filter/Counter Menu contains the **Label** field, the **Action** field, and other fields, as shown in Figure 3-11.

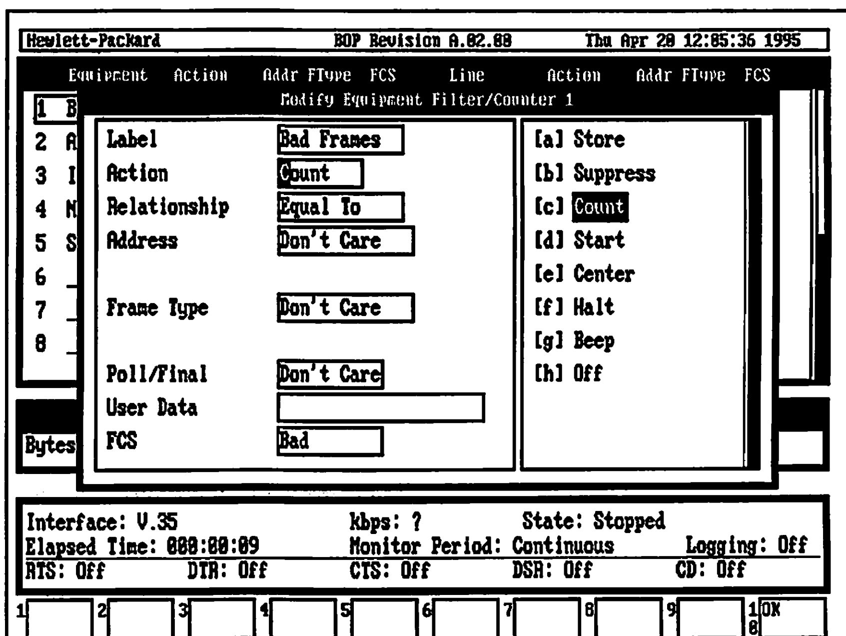


Figure 3-11: Modify Filter/Counter Menu

2. In the fields of the Modify Filters/Counter Menu, make the selections you want. The selections you can make for each field are described after this procedure.

3. When you are done making selections, press **F10** (OK). This saves your selections to the filter/counter you were modifying and returns you to the Filter and Counters screen.

The following sections describe the fields which are available in the Modify Filter/Counter Menu for HDLC tests, X.25 tests, and Frame Relay tests.

HDLC Filters and Counters

These are the fields in the Modify Filter/Counter Menu when you are in an HDLC test:

Label - This field shows the filter/counter's name. You can change the name by typing up to 12 characters of information.

Action - This field controls what action is taken when data meets all the conditions specified by the Modify Filter/Counter Menu. If you choose any action other than Off, new fields appear below the **Action** field in which you can specify additional conditions. The choices for the **Action** field are:

Store	Stores in the Internet Advisor's capture buffer frames that match all the specified conditions.
Suppress	Does not store frames that meet all the specified conditions. That is, frames that match all the specified conditions are excluded from the capture buffer.
Count	Counts the number of frames that match all the specified conditions.
Start	Stores and displays the first frame, and all frames afterwards, that match all the specified conditions.
Center	Stores the first frame that matches all the specified conditions and then continues storing frames matching the specified conditions until approximately half of the capture buffer is full, after which the test is stopped.

Halt	Stores all frames after the start of run and stops the run when a matched frame is encountered.
Beep	Stores all frames that match all the specified conditions and causes the Internet Advisor to emit an audible beep for each frame that meets all the specified conditions. In order to hear the beep, the Internet Advisor's sound must be turned on. Refer to the section "Configuring the Internet Advisor's Sound," in chapter 7, "The Toolkit User Interface," for information on controlling the Internet Advisor's sound.
Off	Turns the filter/counter off.

NOTE If the **Action** field is set to store, suppress, start, center, halt, or beep, the filter/counter also acts as a counter.

NOTE Start, Center, and Halt are mutually exclusive. You may have multiple Start actions, Center actions, or Halt actions, but you may not mix these actions in the same set of filters.

NOTE Filter/Counters 9 through 16 may only serve as counters and provide only Count and Off as a choice for the **Action** field.

Relationship - This field establishes the logical relationship between the filter/counter and the data being acted on. The choices for this field are:

Equal To	Data must match the specified conditions.
Not Equal To	Data must NOT match specified conditions. (Caution: This means everything "Not Equal To" passes this filter.)

Address - The choices for this field are:

Don't Care	Any address is acceptable.

User Defined	If you select this, a new field, **Address Value**, appears in which you can enter a one octet address field in hexadecimal or text format. You can also specify Don't Care.
DCE (01)	Hexadecimal 01.
DTE (03)	Hexadecimal 03.
PPP (FF)	Hexadecimal FF.

Frame Type - The choices for this field are:

Don't Care

User Defined	If you select this, then a new field, **Frame Type Value,** appears in which you can specify the Frame Type Value.

Information
Supervisory
Unnumbered
RR (Receiver Ready)
RNR (Receiver Not Ready)
REJ (Reject)
SREJ (Selective Reject)
SNRM (Set Normal Response Mode)
SARM/DM (Set Asynchronous Response Mode/Disconnected Mode)
SABM (Set Asynchronous Balanced Mode)
SIM/RIM (Set Initialization Mode/Request Initialization Mode)
DISC/RD (Disconnect/Request Disconnect)
UA (Unnumbered Acknowledgment)
UI (Unnumbered Information)
UP (Unnumbered Poll)
RSET (Reset)
XID (Exchange Identification)
SABME (Set Asynchronous Balanced Mode Extended)
TEST
FRMR (Frame Reject)
SNRME (Set Normal Response Mode Extended)
SARME (Set Asynchronous Response Mode Extended)

BCN
CFGR

Poll/Final - The choices for this field for are 0 (Poll), 1 (Final), and Don't Care.

User Data - This field can be up to 62 octets. It can be entered as hexadecimal or as text. It can be loaded from a User Defined Message (*.UDM) file. "Don't Care" octets can be specified. Setting the appropriate values in the octets of **User Data** allows protocol specific parameters and higher level protocols to be counted.

FCS - The choices for this field are:

Good	Test for a good Frame Check Sequence.
Bad	Test for an incorrect Frame Check Sequence.
Abort	Test for the Abort pattern (a zero followed by seven or more ones).
Don't Care	Any FCS is acceptable.

X.25 Filters and Counters

These are the fields in the Modify Filter/Counter Menu when you are in an X.25 test:

Label - Refer to the description of this field in the previous section "HDLC Filters and Counters."

Action - Refer to the description of this field in the previous section "HDLC Filters and Counters."

Relationship - Refer to the description of this field in the previous section "HDLC Filters and Counters."

FCS - Refer to the description of this field in the previous section "HDLC Filters and Counters."

Address - Refer to the description of this field in the previous section "HDLC Filters and Counters."

Frame Type - The choices for this field are:

Don't Care

User Defined	If you select this, then a new field, **Frame Type Value,** appears in which you can specify the Frame Type Value.
Information	If you select this, then a new field, **Data Field,** appears, which can be set to On or Off. If **Data Field** is set to On, a new field, **Data String** appears in which you can enter the data string. If **Data Field** is set to Off, several new fields (**Packet Type, Modulo, Logical Channel,** and **X.25 Data String**) appear on page 2 of the Modify Filter/Counter Menu. Refer to the descriptions of these fields for more information.

Supervisory
Unnumbered
RR (Receiver Ready)
RNR (Receiver Not Ready)
REJ (Reject)
SREJ (Selective Reject)
SNRM (Set Normal Response Mode)
SARM/DM (Set Asynchronous Response Mode/Disconnected Mode)
SABM (Set Asynchronous Balanced Mode)
SIM/RIM (Set Initialization Mode/Request Initialization Mode)
DISC/RD (Disconnect/Request Disconnect)
UA (Unnumbered Acknowledgment)
UI (Unnumbered Information)
UP (Unnumbered Poll)
RSET (Reset)
XID (Exchange Identification)
SABME (Set Asynchronous Balanced Mode Extended)
TEST
FRMR (Frame Reject)
SNRME (Set Normal Response Mode Extended)
SARME (Set Asynchronous Response Mode Extended)
BCN
CFGR

Poll/Final - Refer to the description of this field in the previous section "HDLC Filters and Counters."

Packet Type - The choices for this field are:

Don't Care	
User Defined	Selecting this causes a new field, **Packet Type Value**, to appear in which you can specify the packet type as hex, text, or Don't Care.
Data	Selecting this causes two new fields, **Modulo** and **X.25 Data String**, to appear. You can specify the X.25 Data String as hex, text, or Don't Care. Refer to the description of the **Modulo** field for more information on the Modulo choices.

Call Incom/Req (Call Incoming/Call Request)
Call Conn/Accept (Call Connected/Call Accepted)
Clear Ind/Req (Clear Indication/Clear Request)
Clear Confirm (Clear Confirmation)
RR (Receiver Ready)
RNR (Receiver Not Ready)
REJ (Reject)
Interrupt
Interrupt Confirm (Interrupt Confirmation)
Reset Ind/Req (Reset Indication/Reset Request)
Reset Confirm (Reset Confirmation)
Restart Ind/Req (Restart Indication/Restart Request)
Restart Confirm (Restart Confirmation)
Diagnostic
Registration Req (Registration Request)
Registration Con (Registration Confirmation)

Modulo - This field appears only when the **Packet Type** field is set to Data, RR, RNR, or REJ. The choices for this field are:

8	Only Modulo 8 X.25 packets are acted on.
128	Only Modulo 128 X.25 packets are acted on.

Logical Channel - This field appears only when the **Frame Type** field is set to Information and **Data Field** is set to Off. The choices for this field are:

Don't Care	X.25 packets with any LCN are acted on.
Number	Only X.25 packets in which the LCN matches the specified value are acted on. Selecting Number causes a new field, **LCN Range**, to appear in which you can specify the LCN range.

Frame Relay Filters and Counters

These are the fields in the Modify Filter/Counter Menu when you are in an Frame Relay test:

Label - Refer to the description of this field in the previous section "HDLC Filters and Counters."

Action - Refer to the description of this field in the previous section "HDLC Filters and Counters."

Relationship - Refer to the description of this field in the previous section "HDLC Filters and Counters."

DLCI Range - You can enter an individual DLCI (Data Link Connection Identifier) in this field or a range of DLCIs. The range can be zero through 1023.

D/E - In this field you can enter a value for the Discard/Eligibility bit. The choices are 0, 1, or Don't Care.

FECN - In this field you can enter a value for the Forward Explicit Congestion Notification bit. The choices are 0, 1, or Don't Care.

BECN - In this field you can enter a value for the Backward Explicit Congestion Notification bit. The choices are 0, 1, or Don't Care.

User Data - This field can be up to 62 octets long. It can be entered as hexadecimal or as text. It can be loaded from a User Defined Message (*.UDM) file. "Don't Care" octets can be specified. Setting the appropriate values in the octets of **User Data** allows protocol specific parameters and higher level protocols to be counted.

FCS - Refer to the description of this field in the previous section "HDLC Filters and Counters."

An Example of Modifying Filter/Counters

In this example, we will create a pair of filters in the generic HDLC test to accept good and bad information frames to and from SNA device C1 (Link-Level Address C1). No other frames will be accepted into the capture buffer.

1. In the Main Group\High Speed Analyzr screen, highlight the **HDLC** page icon and press **ENTER**. The Interface Setup Menu opens.
2. From the Interface Setup Menu, press **F5** (Filters Countrs).
3. Make sure **Equipment Filt/Cnt 1** is highlighted, and then press **F2** (Modify Flt/Cnt). The Modify Filter/Counter Menu opens.
4. Type `Good Frame` into the **Label** field.
5. Set the **Action** field to Store.
6. Choose Equal To in the **Relationship** field.
7. Set the **Address** field to User Defined.
8. Enter the hex value `C1` in the **Address Value** field. To do this, hold down the **CTRL** key and press the **H** key, to enter the hex entry mode, and then press the **C** key and then the **1** key.
9. Set the **Frame Type** field to Information.
10. Set the **Poll/Final** field to Don't Care.

11. Do not make any changes to the **User Data** field.

12. Set the **FCS** field to Good. The screen looks like Figure 3-12.

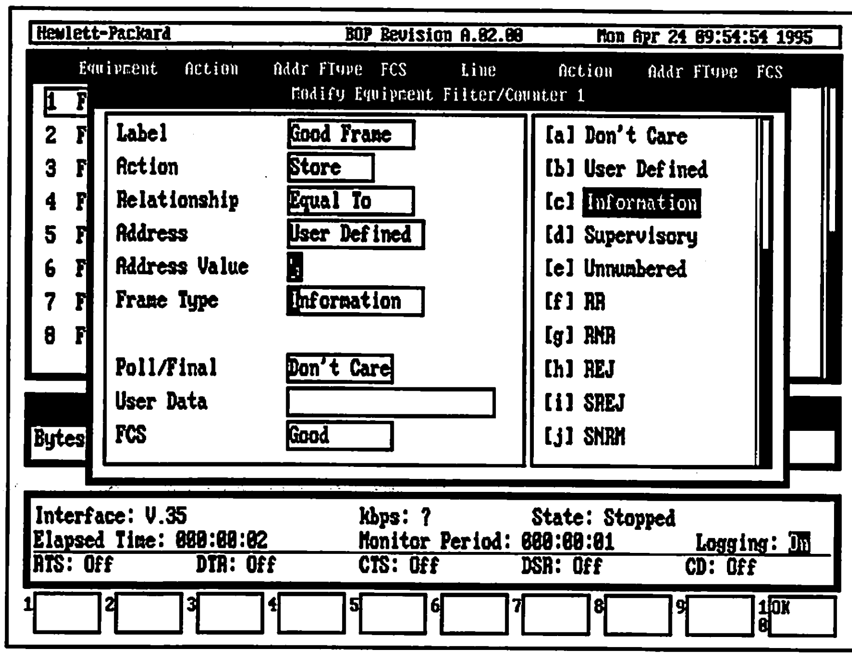


Figure 3-12: Modify Equipment Filter/Counter One

13. Press **F10** (OK). The Modify Filter/Counter Menu closes.

14. Press **F4** (Copy), press the Right Arrow to highlight **Line Filt/Cnt 1**, and then press **F5** (Paste).

15. Press the Down Arrow and the Left Arrow to highlight **Equipment Filt/Cnt 2**, and then press **F5** (Paste). The Good Frame filter/counter is now installed as Equipment Filter/Counters 1 and 2 and Line Filter/Counter 1.

16. While **Equipment Filt/Cnt 2** is still highlighted, press **F2** (Modify Flt/Cnt). This reopens the Modify Filter/Counter Menu.

17. Change the **Label** field to `Bad Frame`.

18. Change the **FCS** field to Bad. Figure 3-13 shows the modified filter.

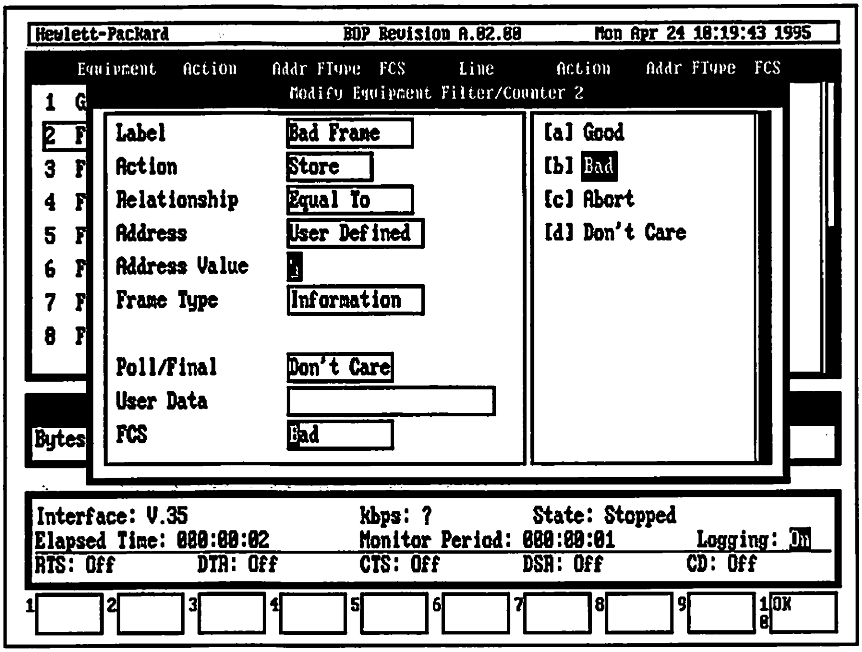


Figure 3-13: Modify Equipment Filter/Counter Two

19. Press **F10** (OK).

20. Press **F4** (Copy), and then press the Right Arrow to highlight **Line Filt/Cnt 2.**

21. Press **F5** (Paste). Figure 3-14 shows the Filter and Counters screen with the four modified filters.

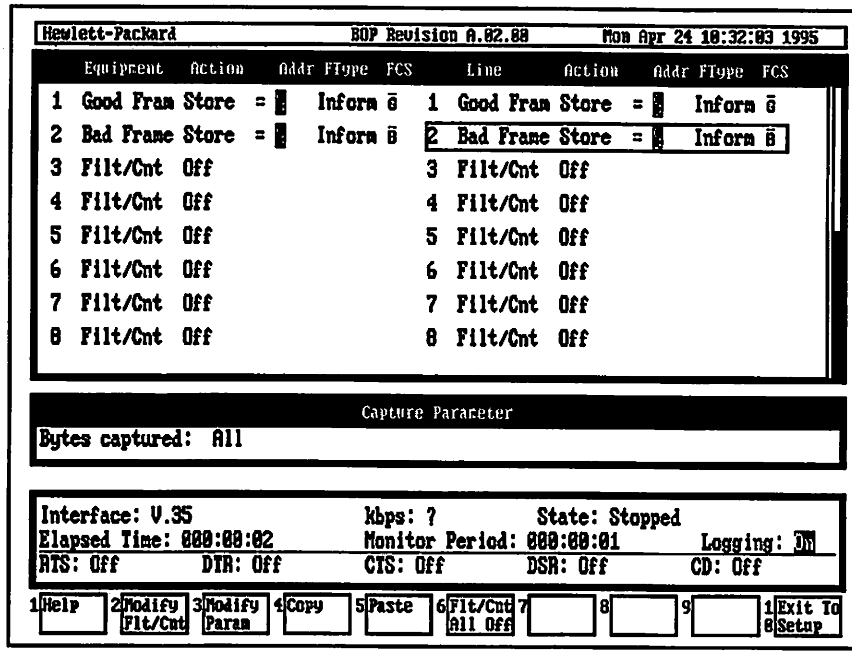


Figure 3-14: Modified Equipment and Line Filter/Counters

Figure 3-15 is an example of how our two pairs of filters might operate if we pressed **F7** (Stats & Countrs), then **F9** (start Monitor), then **PgDn**. The left column, EQ, shows the Equipment or DCE statistics. The right column, LN, shows the Line or DTE measurements. Figure 3-15 shows that the Data Terminal Equipment created 15,897 good frames and no bad ones. (We would expect zero errors from a DTE to which we are connected.) It received 28,298 good frames and 4 bad frames from the line. (We expect some errors from the communications link.) Only the information traffic for station C1 was captured. Frames to and from other stations were excluded from the buffer. If we wanted, we could examine the captured errored frames to see if there was something of a particular nature about the errors. For more information on doing this, refer to chapter 4, "Monitoring."

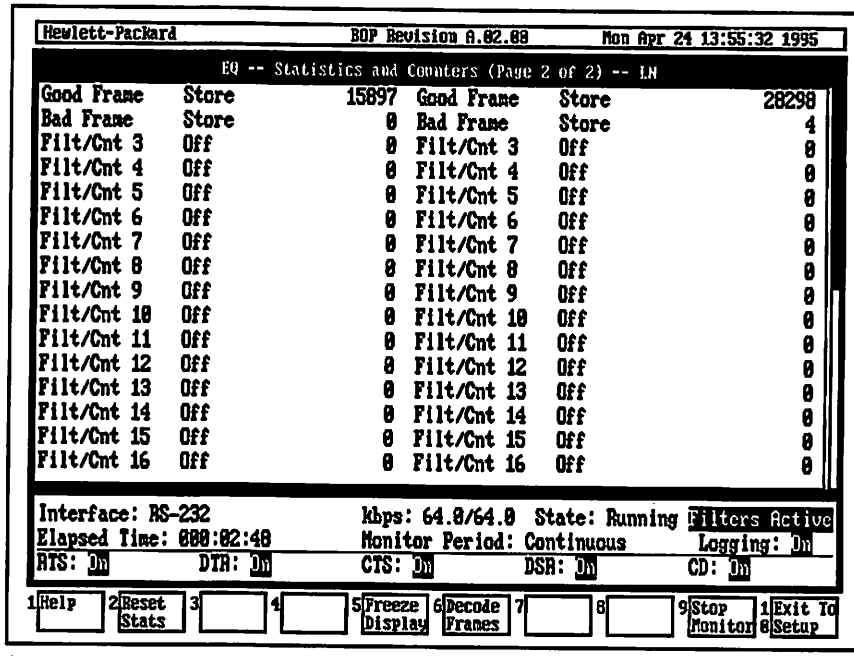


Figure 3-15: Statistics and Counters

Run Configuration

The Run Configuration Menu lets you establish the monitoring and statistics logging mode of the Internet Advisor. Press **F9** (Run Config) from the Interface Setup Menu to open the Run Configuration Menu. The fields in the Run Configuration Menu vary according to which test you are in. Figure 3-16 shows the possible fields in the Run Configuration Menu for HDLC tests and for the SMDS Monitor test.

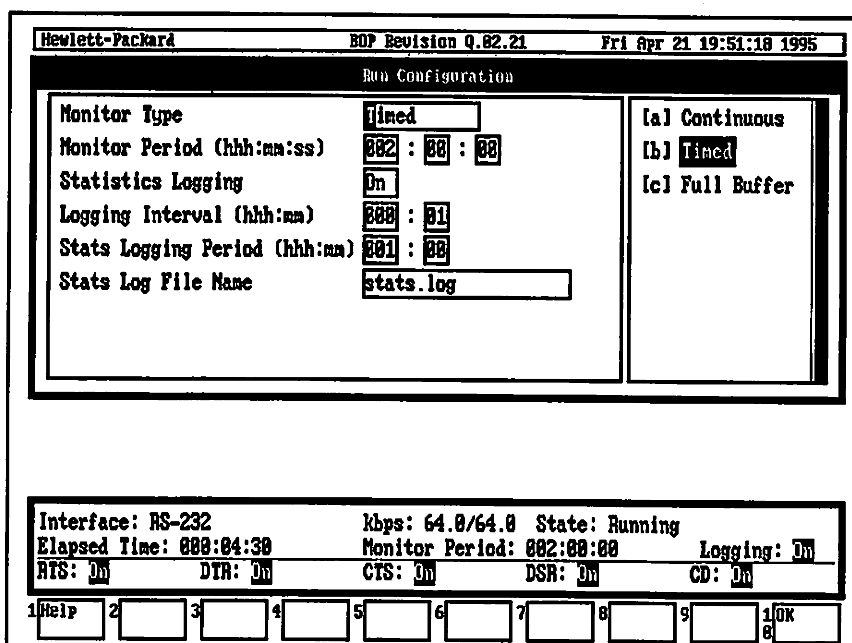


Figure 3-16: Run Configuration Menu for HDLC and SMDS Monitor

These are the fields in the Run Configuration Menu:

Monitor Type - The following are your choices:

Continuous	Data is captured to a "circular" buffer. After the buffer is filled, the most recent data overwrites the oldest data. The standard buffer size is 2 Mbytes with an option for 30 Mbytes.
Timed	Data is captured for a specified length of time. If you select this, a new field, **Monitor Period (hhh:mm:ss)**, appears, in which you can specify the length of time you wish to collect data in hours, minutes, and seconds.
Full Buffer	Data is captured until the buffer is full, and then data capture is stopped. (Not available with SMDS Monitor test.)

Statistics Logging - The choices for this field are:

On

Statistics Logging is enabled. Selecting on causes three new fields to appear: **Logging Interval (hhh:mm), Stats Logging Period (hhh:mm),** and **Stats Log File Name.**

Logging Interval is the length of time for a statistics sample to be made. This may be as little as one minute or as much as 999 hours, 59 minutes. At the end of this interval, the statistics obtained are logged to disk and all counters are reset to zero. To obtain more than one statistics sample, **Stats Logging Period** must be set to something greater than **Logging Interval.** The range for **Stats Logging Period** is also one minute to 999 hours, 59 minutes. The total number of samples logged will be **Stats Logging Period** divided by **Logging Interval.**

The **Stats Log File Name** field requires you to choose a name for the log file. The default path and file name is `C:\HPTOOLS\DATA\STATS.LOG`. Always specify the complete path, file name, and a file extension of `.LOG`. If you want to browse the disk, press **ENTER**.

Off

No statistics logging.

The Run Configuration Menu for X.25 has two additional fields: **LCN Statistics** and **Level 2 Extended Control.** Figure 3-17 shows the Run Configuration Menu for X.25.

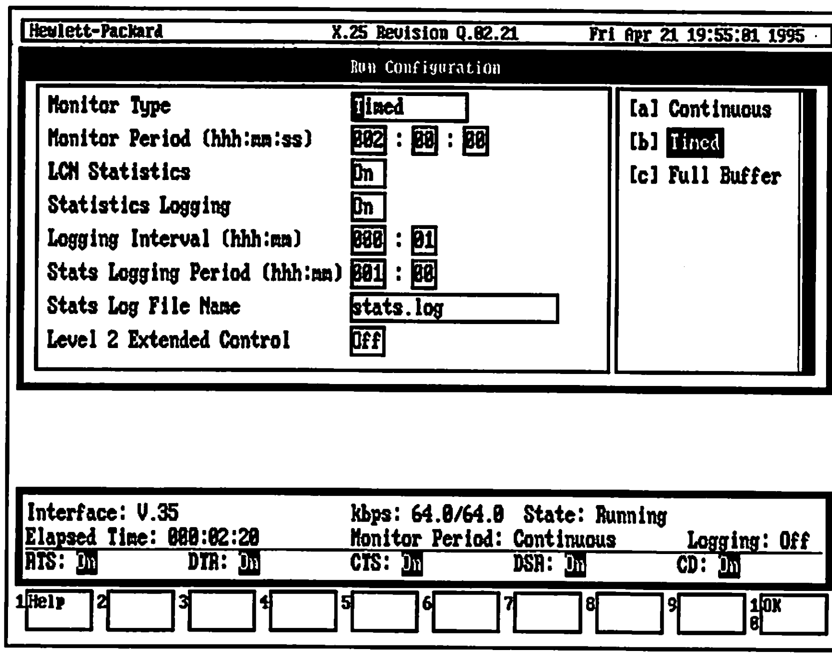


Figure 3-17: X.25 Run Configuration Menu

LCN Statistics - The choices for this field are:

On — Log the LCN-specific statistics. You can view LCN statistics in the LCN Statistics screen, which can be accessed by pressing **F7** (Stats & Countrs) from either the Interface Setup Menu or the Decode display, and then pressing **F7** (LCN Stats).

Off — Do not log LCN statistics.

Level 2 Extended Control - The choices for this field are:

On — Select this if level 2 extended control is being used on the link under test. To log correctly decoded frames, level 2 extended control must also be configured in the decode. To do this, press **F6** (Decode Frames), and then **F2** (Decode Config). Highlight **X.25 Layer 2,** and then press **ENTER.** Make sure the **Extended Control** field is set to On.

Off — Select this if level 2 is using single-octet control fields.

The Run Configuration Menu for Frame Relay tests adds a field for **DLCI Statistics**. This is shown in Figure 3-18.

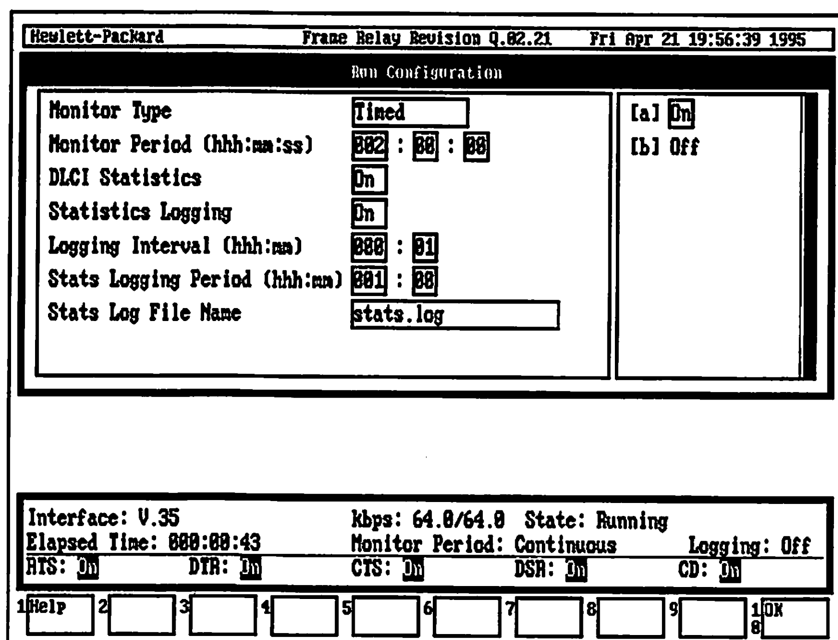


Figure 3-18: Run Configuration Menu for Frame Relay

DLCI Statistics - The choices for this field are:

On	Log the DLCI-specific statistics. You can view DLCI statistics using the DLCI Statistics screen, which can be accessed by pressing **F7** (Stats & Countrs) from either the Interface Setup Menu or the Decode display, and then pressing **F7** (DLCI Stats).
Off	Do not log DLCI statistics.

4

Monitoring

Introduction to Monitoring

When the Internet Advisor monitors, it captures data occurring on the network. Monitoring is a passive process because the Internet Advisor does not generate or send any data. In contrast, during simulation and BERT testing, the Internet Advisor does generate and send data, and it also monitors.

There are two main objectives during monitoring:

- Decode the data that is captured from the network under test.
- Make statistical measurements on the data that is captured from the network under test.

The Internet Advisor decodes bit-oriented, wide area communications protocols. To do this, it uses a "front-end" data capture buffer and hardware filters and counters. "Front end" data filtering controls what is admitted to or restricted from the capture buffer. (Refer to chapter 3, "Configuring the Internet Advisor," for information on using the filters and counters.) A broad group of decodes is available for presenting the captured data in the most meaningful form. You can customize the decodes to display the specific protocol layers of interest.

Decoding data communications traffic provides you with information which is useful for network management and troubleshooting. The most basic function of decoding is to show you the data on the communications link so that you can examine it. It is important to see communications protocols in action so that you can verify that all the devices are handling the protocols correctly. If inappropriate traffic is present, you can easily identify the source in order to take corrective action.

Sometimes it is sufficient to merely decode network addresses to insure that the data on the link is being properly routed. If unintended traffic is present, it is appropriate to reconfigure some of the network devices. Protocol decodes help indicate which devices require attention.

Decodes can be used to verify that expected protocols are present, and, perhaps more importantly, discover whether unexpected protocols are present on the link. This is of special importance when wide area links are connecting LAN segments together. It is critical to withhold unnecessary LAN traffic from the relatively slower WAN link to avoid limiting throughput.

The statistics capabilities of the Internet Advisor are an excellent adjunct to the decode capabilities. There are a number of statistical measures which are specific to a particular interface technology, such as counting Bipolar Violations for a T1 connection. There are other measures of a more general nature, such as octet and frame counts. Additionally, there are 16 filter/counters which you can define for specific purposes. With the appropriate counters established, you can characterize the distribution of protocols present on the link. (Here too, you may discover some unexpected traffic appearing as counts in the statistical measurements.) Several preconfigured tests are provided with the Internet Advisor which make use of these filter/counters to create statistical "signatures" of your network in operation. (Refer to Appendix B, "Supplied Tests," for information on the supplied preconfigured tests, and refer to chapter 3, "Configuring the Internet Advisor," for information on filters and counters.)

To monitor, do the following:

1. Connect the Internet Advisor to the network you want to test. Refer to chapter 2, "Connecting to the Network," for more information.

2. From the Main Group screen (the Internet Advisor's power-on screen), highlight **High Speed Analyzr** and press **ENTER**.

3. In the Main Group\High Speed Analyzr screen, select the appropriate test. For example, if you want to monitor X.25, you can select the generic X.25 test by highlighting the **X.25** page icon (▤) and pressing **ENTER**. The Interface Setup Menu is displayed.

4. Set the **Interface Type** field to Monitor, and set the other fields in the Interface Setup Menu to match the network you are going to test. Refer to chapter 3, "Configuring the Internet Advisor," for more information on using the Interface Setup Menu.

5. Press **F6** (Decode Frames) and then **F9** (Start Monitor). The Detailed Decode display begins showing the captured and decode data. An example of the Detailed Decode display for X.25 is shown in Figure 4-2 in the section "Understanding the Decode Displays."

6. To view the data in the Summary Decode format, press **F6** (Summary Display). An example of the Summary Decode display for X.25 is shown in Figure 4-1 in the section "Understanding the Decode Displays."

7. To view link level statistics, T1 statistics (if the **Interface Type** field is configured for T1), and E1 statistics (if the **Interface Type** field is configured for E1), press **F7** (Stats & Countrs). Refer to the "Statistics" section for more information.

NOTE After stopping monitor or simulate operations, the Detailed and the Summary Decode displays return to the earliest event in the capture buffer.

Decode Softkeys

In either the Detailed Decode display or the Summary Decode display, the following softkeys are available when the Internet Advisor is in the monitor mode (that is, when the **Interface Type** field in the Interface Setup Menu is set to Monitor):

F1 (Help)	Accesses the Internet Advisor's Help System.
F2 (Decode Config)	Lets you load and configure decodes. Refer to the "Decode Configuration" section for more information.
F3 (Decode Utils)	Lets you print and save data and search for specific strings of data or frame types once monitoring is stopped. Refer to the "Decode Utilities" section for more information.
F4 (Go To Event)	Each event in buffer memory is numbered after monitoring is stopped. This softkey lets you specify which event to display once monitoring is stopped.

F5 (Go To Time)	Each event in buffer memory is time stamped. This softkey lets you specify which time to display once monitoring is stopped.
F5 (Freeze Display) **F5** (Cont. Display)	While you are monitoring, this softkey pauses and unpauses the display. When the display is paused, data capture still continues.
F6 (Summary Display) **F6** (Detail Display)	Toggles between the Detailed Decode display and the Summary Decode display.
F7 (Stats & Countrs)	Opens the statistics displays. Refer to the "Statistics" section for more information.
F8 (Simulate)	Takes you to the Simulate Program Snapshot screen. Refer to chapter 5, "Simulating," for more information.
F9 (Start Monitor) **F9** (Stop Monitor)	Starts and stops monitoring.
F10 (Exit To Setup)	Returns to the Interface Setup Menu.

Understanding the Decode Displays

You can view decoded data in two formats:

- The Detailed Decode display shows a more detailed view of the captured data.
- The Summary Decode display shows a less detailed view of the captured data.

Either decode display can be used when you are monitoring live data (data occurring on the network) or previously captured data. In both decode displays, the bottom part of the window (called the Status area) shows additional information.

Summary Decode Display

Figure 4-1 shows an example of the Summary Decode display. In this figure, X.25 data is being decoded.

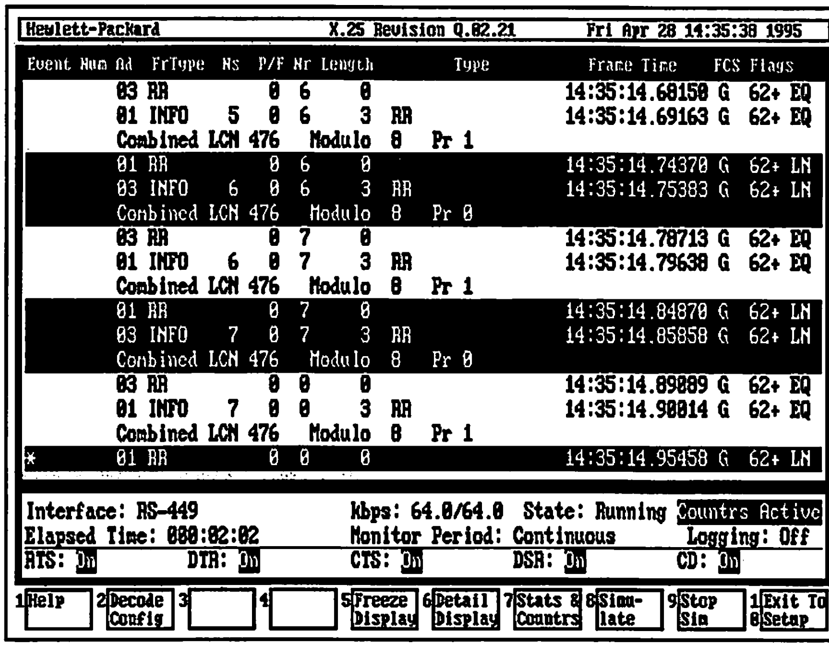


Figure 4-1: Summary Decode Display of an X.25 Dialog

The top line of the Summary Decode display contains the following column headings:

Event Num	The first column shows the event numbers. Event numbers only shows when you are examining data that is already in the capture buffer. That is, no event numbers are shown when live traffic is being displayed.
Ad	This column shows the layer 2 address.
FrType	This column shows the layer 2 frame type, for example RR (Receiver Ready).

Ns	This column shows the Frame Send Sequence number.
P/F	This column shows the Poll/Final bit value.
Nr	This column shows the Next Receive Frame Expected number.
Length	This column shows the length of the layer 2 information field in octets. Length does not include the Address, Control, or FCS fields.
Type	This column shows the layer 3 message type, for example, RR (Receiver Ready).
Frame Time	This column shows the frame's time stamp in the format of hour:minute:second.
FCS	This column shows the condition of the Frame Check Sequence (Good, Bad, or Abort).
Flags	This column shows the number of HDLC flag patterns between adjacent frames. The minimum is `1`. Greater than 62 is denoted as `62+`.

The right-most column tells the type of event: EQ (Equipment/DTE data) or LN (Line/DCE data). In the bottom window (the Status Area), Leads information is shown. For example, a change of state of one or more of the interface control signals on the V-Series interfaces is shown.

Some of the events shown in Figure 4-1 are layer 2 only. For example, layer 2 RR (Receiver Ready) frames being exchanged. There are also some frames with higher-level information. In the X.25 decode, when decodeable higher-level information is present, it is presented on the second line of the event (see note). In Figure 4-1, the INFO (Information) frames contain X.25 layer 3 Receiver Ready (RR) packets. Observing the time stamps in Figure 4-1, it appears that the exchange of layer 3 Receiver Ready packets is happening much too often. (Once per second would be more typical.) This suggests that the communicating devices might need reconfiguration to reduce this overhead traffic on the link.

NOTE

Higher-level information is shown on a separate line only in the X.25 decode. In the Frame Relay and HDLC decodes, a single line is used even when higher-level information is present.

Status Area of the Decode Displays

When a test is running, the bottom (status) area of the decode display provides information regarding the interface in use, the data rate in kbps (see note below), the state of the machine (Running or Stopped), whether the counters/filters are active, the elapsed time of the test (HHH:MM:SS), the Monitor Period, and whether Statistics Logging is On or Off.

NOTE

When the Internet Advisor begins a V-series monitor or simulate test, it makes a measurement of the incoming clock rates. These rates can be different if the Equipment/DTE is self-clocking or if the number of T1/E1 time slots is different between the channels. This measurement is only made at the beginning of a V-Series test. For T1 or E1 tests, the data rate that is shown is what data rate is selected in the **User Chan Rate** field of the Interface Setup Menu.

Also while running, the state of the five major interface control signals are shown for the V-Series interfaces. When a control lead changes state, a one-second message is displayed to indicate that the signal has "toggled" (changed state). If a T1 or E1 interface is in use, the status report on the bottom line gives the signal condition of the Equipment and the Line channel (Normal or Signal Loss). More extensive T1 or E1 statistical information is available. Refer to the "Statistics" section of this chapter.

When the test is stopped, the status area displays the number of events captured (frames, control lead transitions of the V-Series interfaces, and line state changes for T1 and E1 interfaces), and the range of events available in the buffer.

Detailed Decode Display

Figure 4-2 shows the same X.25 data which is shown in Figure 4-1 expanded into the Detailed Decode format after monitoring was stopped. Notice that there are now event numbers.

In the Detailed Decode display, on color displays, each protocol layer is distinctly color-coded. In Figure 4-2, event 4 shows the layer 2 decoded information first and then the X.25 layer 3 information is decoded below the layer 2 data. Event 4 is a Call Request packet. The delivery bit is 0 (normal delivery) and the packets are being counted in Modulo 8 (0 to 7). The Logical Channel Group Number (LCGN) is 1, and the Logical Channel (LCN) is 220 giving a "Combined LCN" of 476 (1 X 256 + 220 = 476). Event 4 is decoded in the right column, so it represents Line (DCE) data.

NOTE

The initial definition of X.25 included a 4-bit field called Logical Channel Group Number (LCGN), whose range was 0 to 15. The rest of the Logical Channel Identifier was an 8 bit field called Logical Channel Number (LCN), whose range was 0 to 255. Most current implementations regard X.25 as having a 12 bit address, combining LGCN and LCN to give the Combined LCN with a range of 0 to 4095. The Internet Advisor reports LGCN, LCN, and their combined value.

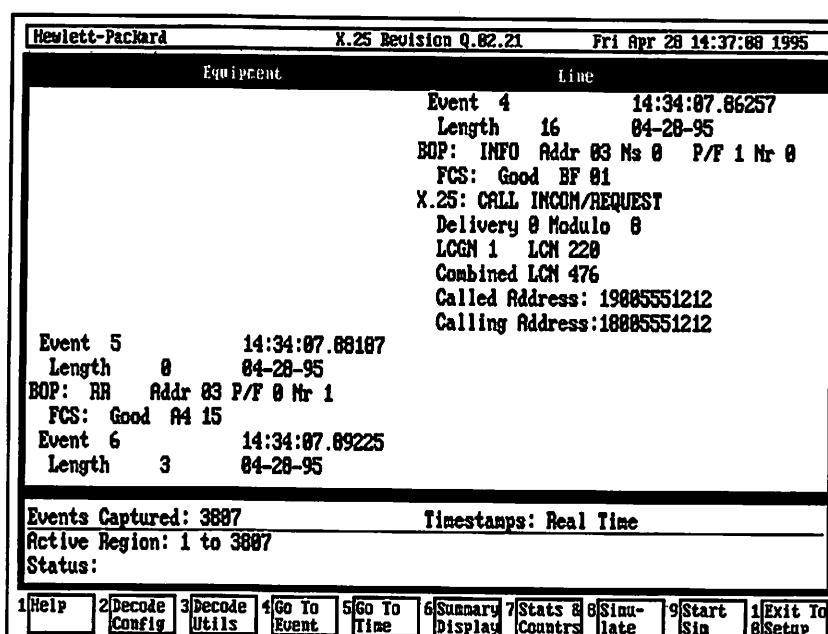


Figure 4-2: Detailed Decode of an X.25 Dialog (from Buffer)

Figure 4-3 is another example of a Detailed Decode display. In this figure, the LAN-over-WAN TCP/IP decode is being used to show a decoded TCP/IP frame which has been captured from the link. Of particular interest might be the fact that IP station 192.100.81.124 is making a transmission to IP station 15.254.192.1, which might prompt you to ask whether this particular traffic belongs on this particular link.

NOTE For a complete description of the LAN Over WAN tests, refer to Appendix B, "Supplied Tests."

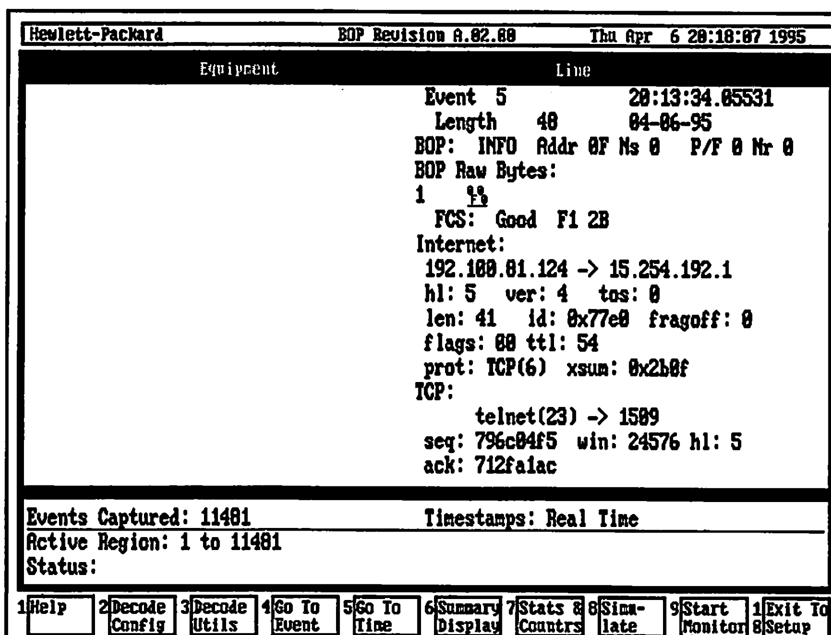


Figure 4-3: Detailed Decode of a TCP/IP Frame (from Buffer)

Decode Configuration

When you start a test, the appropriate decodes are automatically loaded and a protocol stack is automatically configured. This determines what protocols are shown in the Detailed and Summary Decode displays.

At minimum there will always be two decodes loaded in the Internet Advisor. The first is a decode to handle layer 2 data. BOP is the generic HDLC-derivative decode that handles layer 2 data. In the X.25 tests, this decode is called X.25 Layer 2 (LAP-B); in the Frame Relay tests, it is called Frame Relay (LAP-F); and in the SMDS tests, it is called SMDS Layer 2.

The other decode always loaded is User Data. This is usually the last protocol in a stack, and it is used to display all of the bytes beyond the last-decoded protocol level.

For some tests, a layer 3 decode is also loaded. For example, if you select the generic X.25 test (described in Appendix B, "Supplied Tests"), the X.25 Layer 2 decode is loaded, the X.25 Layer 3 decode is loaded, and the User Data decode is loaded. In addition, a protocol stack is configured, such that the X.25 Layer 2 decode is told to use the X.25 Layer 3 decode to decode the next (higher) layer, and the X.25 Layer 3 decode is told to use the User Data decode to decode the next (higher) layer.

Table 4-1 shows the decodes which are automatically loaded and the protocol stacks which are automatically configured for the generic HDLC, X.25, and Frame Relay tests, and for the SMDS Monitor test. The lowest-layer decode is shown in the bottom row and the highest-layer decode is shown in the top row.

NOTE

For some of the preconfigured tests (for example, the preconfigured Frame Relay ITUT LMI Monitor tests), the decodes which are automatically loaded and the stacks which are automatically configured differ from the decodes loaded and the stacks configured for the generic tests.

Table 4-1: Automatically Configured HDLC, X.25, Frame Relay, and SMDS Decode Stacks

HDLC	X.25	Frame Relay	SMDS
	User Data		
User Data	X.25 Layer 3	User Data	User Data
BOP	X.25 Layer 2	Frame Relay	SMDS Layer 2

Table 4-2 shows the decodes which are automatically loaded and the protocol stacks which are automatically configured for the LAN over WAN tests (described in Appendix B, "Supplied Tests"). In these tests, the LAN-1 decode passes unrecognized frames to the LAN-2 decode.

Table 4-2: Automatically Configured LAN Over WAN Decode Stacks

	Router, Bridge, & HDLC Tests	PPP Tests*	X.25 Tests	Frame Relay Tests**
Data	User Data	User Data	User Data	User Data
LAN Layers 2-7	LAN-1 & LAN-2	LAN-1 & LAN-2	LAN-1 & LAN-2	LAN-1 & LAN-2
WAN Layer 3		LCP/User Data	X.25 Layer 3	LMI **
WAN Layer 2	BOP	BOP	X.25 Layer 2	Frame Relay

* LCP is the Link Control Protocol extension to PPP (Point-to-Point Protocol). It provides internodal communication separate from the end-user traffic. When LCP is loaded it does not need to be selected as the **Next Protocol** in the Decode Configuration Menu.

** When LMI is loaded it does not need to be selected as the **Next Protocol** in the Decode Configuration Menu.

In addition to the decodes which the Internet Advisor automatically loads for you when you start a test, you can load additional decodes, unload currently loaded decodes, and configure a new protocol stack. This procedure is described in the next section.

Loading/Unloading Decodes and Configuring Protocol Stacks

To load additional decodes, unload currently-loaded decodes, or configure a protocol stack, do the following:

1. From either the Detail Decode display or the Summary Decode display, press **F2** (Decode Config). This opens the Display Configuration screen. Figure 4-4 shows an example. The Protocol column shows you what decodes are currently loaded, and the Display Output column shows what protocols will be displayed (those for which Display Output is set to On).

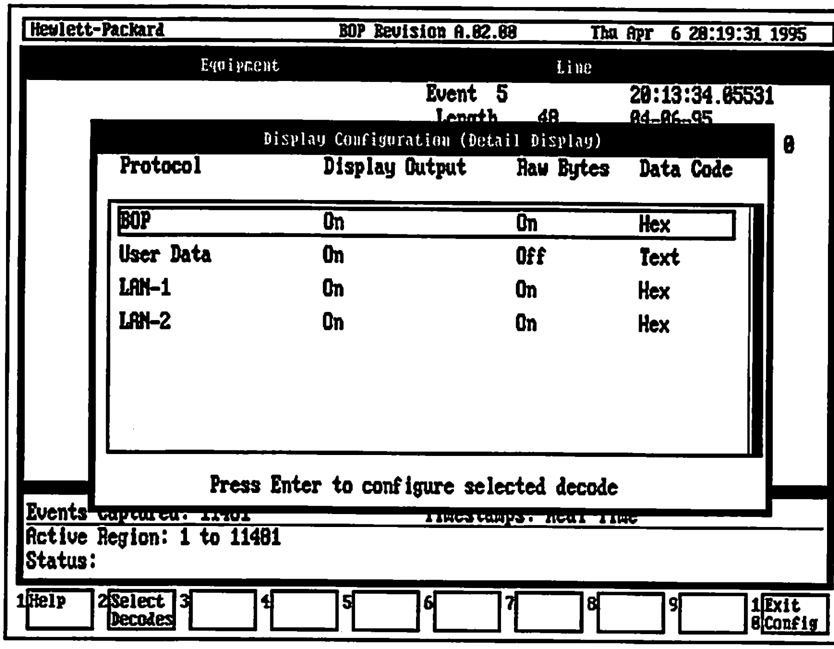


Figure 4-4: Display Configuration Screen

2. Press **F2** (Select Decodes). The Decode Loading/Unloading screen, shown in Figure 4-5, is opened.

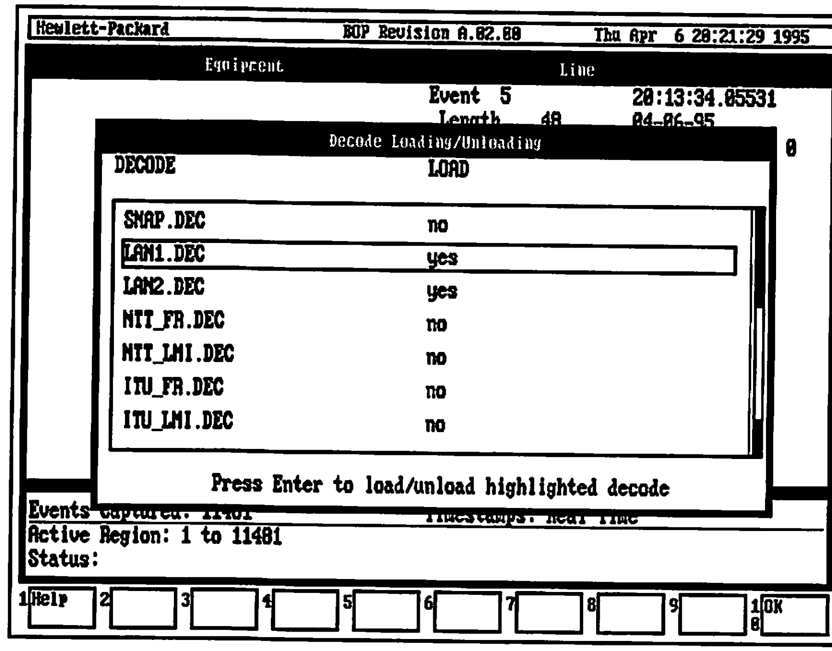


Figure 4-5: Decode Loading/Unloading Screen

The available decodes are:

BOP.DEC	Decodes HDLC Layer 2 data.
FRELAY.DEC	Decodes Frame Relay Layer 2 (LAP-F) data.
IP.DEC	Decodes Internet Protocol data. (Use this only to search on IP Source and Destinations in captured IP data.)
LCP.DEC	Decodes PPP (Point-to-Point Protocol) Link Control Protocol data. You always need to load this if you want it decoded, but you do not need to select it in the **Next Protocol** field. PPP is on the link under test.

LMI.DEC	Decodes Frame Relay Layer 3 data. You always need to load this if you want it decoded, but you do not need to select it in the **Next Protocol** field. PPP is on the link under test.
SMDSL2.DEC	Decodes SMDS Layer 2 data.
SMDSL3.DEC	Decodes SMDS Layer 3 data. If you are using the preconfigured SMDS Monitor test, you may want to load this layer 3 decode because it is not loaded by the SMDS Monitor test.
SNAP.DEC	Decodes Sub-Network Access Protocol data.
LAN1.DEC	Decodes 3Com, Appletalk, Novell, TCP/IP, and XNS Stacks.
LAN2.DEC	Decodes DECnet, Netbios, and SNA Stacks.
NTT_FR.DEC	Decodes Nippon Telephone and Telegraph Frame Relay Traffic.
NTT_LMI.DEC	Decodes Nippon Telephone & Telegraph Frame Relay LMI.
ITU_FR.DEC	Decodes International Telecommunications Union F-Relay Traffic.
ITU_LMI.DEC	Decodes International Telecommunications Union F-Relay LMI.
X25L2.DEC	Decodes X.25 Layer 2 (LAP-B) data.
X25L3.DEC	Decodes X.25 Layer 3 data.

3. To load a decode, use the Up and Down arrows to highlight the decode of interest, and then press **ENTER** to change the decode's load status to `yes`.

In most cases, there only needs to be one Layer 2 protocol loaded. For PPP (Point-to-Point Protocol) links, load `BOP.DEC` for level 2, `LCP.DEC` for higher-level link control, plus the decode to match the traffic present on the link.

To see LAN traffic over your WAN link, load `LAN1.DEC` and/or `LAN2.DEC`.

NOTE

Because of the variety of possible combinations of LAN and WAN protocols which might be found on a WAN link, some judicious choices may need to be made about which decodes to load and how they should interrelate. Specifically, a number of different encapsulation schemes are in use. The LAN over WAN supplied tests (described in Appendix B, "Supplied Tests") support several such encapsulations. However, you might need to configure the Internet Advisor specifically for the encapsulations on your links.

4. To unload a decode, use the Up and Down arrows to highlight the decode of interest, and then press **ENTER** to change the decode's load status to `no`.

5. Press **F10** (OK). All decodes marked `yes` are loaded, all decodes marked `no` are removed, and you are returned to the Display Configuration screen.

Although the decodes you selected are now loaded, in order to see the data they decode, you must configure a protocol stack. For example, if you loaded a layer 3 decode, you must tell the layer 2 decode to use that layer 3 decode for the next level of decoding.

NOTE

If you loaded the `LCP.DEC` or `LMI.DEC` decodes, you do not need to tell the previous-layer decode to use them the next protocol. That is, you do not need to select them as the next protocol in the **Next Protocol** field of the Decode Configuration Menu.

6. Use the arrow keys to highlight the layer 2 decode and press **ENTER**. You will see a Decode Configuration Menu similar to the one shown in Figure 4-6.

7. Make the appropriate selections for the fields in the Decode Configuration Menu and then press **F10** (OK). Each of the fields and their choices are described after this procedure.

8. Repeat steps 6 and 7 for each decode, and then press **F10** (Exit Config) to return to the decode display.

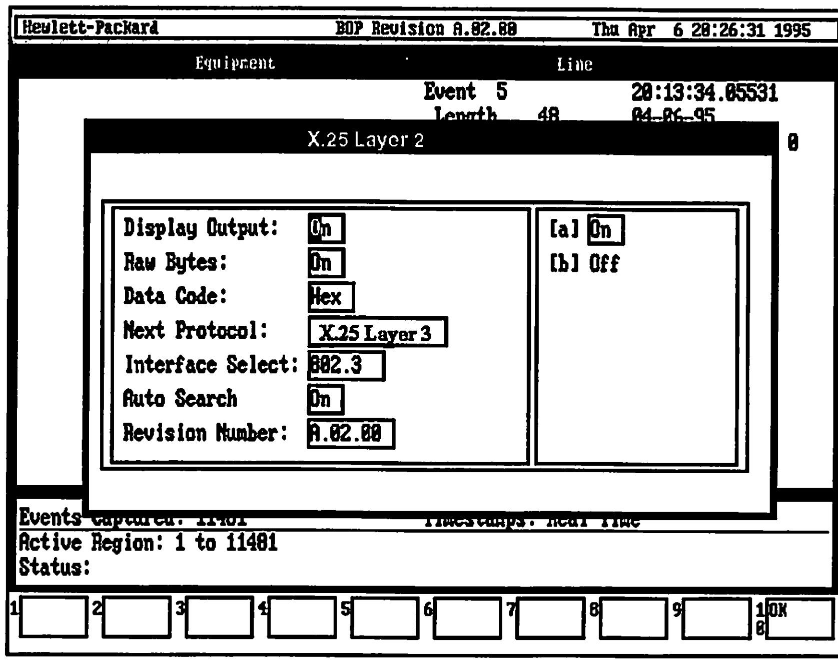


Figure 4-6: LAN-1 Decode Configuration Menu

The following are the fields in the various Decode Configuration Menus. All of these fields are not available in every Decode Configuration Menu; only the fields which pertain to the particular decode/layer you are configuring are available.

Display Output - The following are the choices for this field:

On	Decode and display the data.
Off	Decode but do not display the data.

Raw Bytes - The following are the choices for this field:

On	Display the byte values plus the protocol decode.
Off	Display only the decode.

Data Code - If the **Raw Bytes** field is set to On, then the following are the choices for the **Data Code** field:

Hex	Show the data as hex pairs.
Text	Show the data as ASCII or EBCDIC characters, depending on what you select for the **Text Data Code** field (which only appears in the Decode Configuration Menu for the User Data decode.)

Text Data Code - This field is available in the User Data Decode Configuration Menu. The choices for this field are:

ASCII	Show the data as ASCII characters.
EBCDIC	Show the data as EBCDIC characters.

Next Protocol - This field is what establishes the links between the decodes to create a protocol stack. The choices for this field are whatever decodes are currently loaded. Select the next highest level decode. For example, if you are configuring layer 2, select a layer 3 decode for this field. If you are configuring layer 3, select the User Data decode or the LAN decodes for this field.

NOTE

If you loaded the `LCP.DEC` or `LMI.DEC` decodes, you do not need to tell the previous-layer decode to use them the next protocol. That is, you do not need to select them as the next protocol in the **Next Protocol** field of the Decode Configuration Menu.

Extended Control - This field is available in the BOP and X.25 Layer 2 Decode Configuration Menu. The following are the choices for this field:

Off	Decode single-byte layer 2 control fields. N(S) and N(R) are counted modulo 8 (0 to 7).
On	Decode two-byte layer 2 control fields. N(S) and N(R) are counted modulo 128 (0 to 127). Refer to the "Run Configuration" section of chapter 3, "Configuring the Internet Advisor," for information on turning on Level 2 Extended Control there also.

Bytes to Next Protocol - This field is used to specify the number of bytes (octets) to skip before beginning the next decode. This is used primarily for proprietary frame encapsulation. The range you can enter is `0` to `100`.

Facilities - This field is available in the X.25 Layer 3 Decode Configuration Menu. The following are the choices for this field:

On	Decode and present the Facilities fields.
Off	Do not decode nor present the Facilities fields.

Interface Select - This field (shown in Figure 4-6) is available in the LAN-1 and LAN-2 Decode Configuration Menu. For WAN links carrying LAN traffic in which the LAN layer 2 addresses are present (such as bridge traffic), the Internet Advisor decodes and presents the LAN layer 2 addresses. The following are the choices for LAN-1 and LAN-2:

802.5	Token Ring.
802.3	IEEE 802.3/Ethernet.
Neither	LAN layer 2 addresses are not present or are to be skipped over.
SNA over Lvl2	Normal SDLC. Available only for LAN-2.

Auto Search - In the LAN-1 or LAN-2 Decode Configuration Menu, if you select 802.3 or Neither in the **Interface Select** field, then another field, **Auto Search,** appears. IEEE 802.3 and DIX/Ethernet identify subsequent protocols in a

different manner. If you turn **Auto Search** on, the Internet Advisor searches the next 40 octets beyond the WAN layer 2 header to determine the next higher protocol in the LAN protocol stack.

As an example of using Auto Search, consider the following WAN encapsulated LAN frame. The beginning octets are shown as hexadecimal pairs.

```
<Start Flag> 03 28 46 C0 7D 12 78 04 30 1A 00 DD 01
             0F 1D 22 00 DD 01 10 3F 88 06 00 FF FF
             00 27 00 05 ...
```

An HDLC configuration would recognize the first and second octets as the layer 2 address and control fields. It would decode these octets and pass the remaining octets to the Auto Search function, which finds the beginning of LAN decodeable data.

When doing an Auto Search, the Internet Advisor attempts to compare known octet sets with the octets found in the first 40 positions of the frame being tested. One of the octet patterns it tries to match is `06 00 FF FF`, which it recognizes as Ethernet XNS. When it finds this pattern, it passes the remaining octets into the XNS portion of the decoding system.

NOTE

In some complex encapsulations, the Auto Search function can find patterns which mimic the beginning of LAN decodeable data. If this happens, the decoded data will be unusable. In such a case, set the **Auto Search** field to Off in the LAN-1 configuration, and enter an offset value for the **Bytes to Next Protocol** field in the layer 2 Decode Configuration Menu. In the example above, an offset of 20 bytes would find the LAN protocol signature.

Revision Number - This field shows the Hewlett-Packard Internet Advisor software revision level. This is not a user-configurable item.

An Example of Loading Decodes and Configuring a Protocol Stack

As an example of configuring decodes, assume that your enterprise network is a collection of Ethernet LANs connected together through an X.25 network. A few of the links in the X.25 network are actually Frame Relay. On these links, the complete X.25 frame is encapsulated into the Frame Relay frame. For this example, we will modify one of the supplied preconfigured LAN Over WAN Frame Relay monitor tests (described in Appendix B, "Supplied Tests") to monitor the traffic and make statistical measurements.

1. In the Main Group screen (the Internet Advisor's power-on screen) highlight **High Speed Analyzr** and press **ENTER**.

2. Highlight **Frame Relay Tests** under **LAN Over WAN Tests** and press **ENTER**.

3. Under **LAN Traffic Counts**, highlight **RS449/V36 Monitor** and press **ENTER**. The Statistics and Counters screen is displayed and the test is started.

4. Press **F6** (Decode Frames) and then **F2** (Decode Config). Figure 4-7 shows the initial Display Configuration screen.

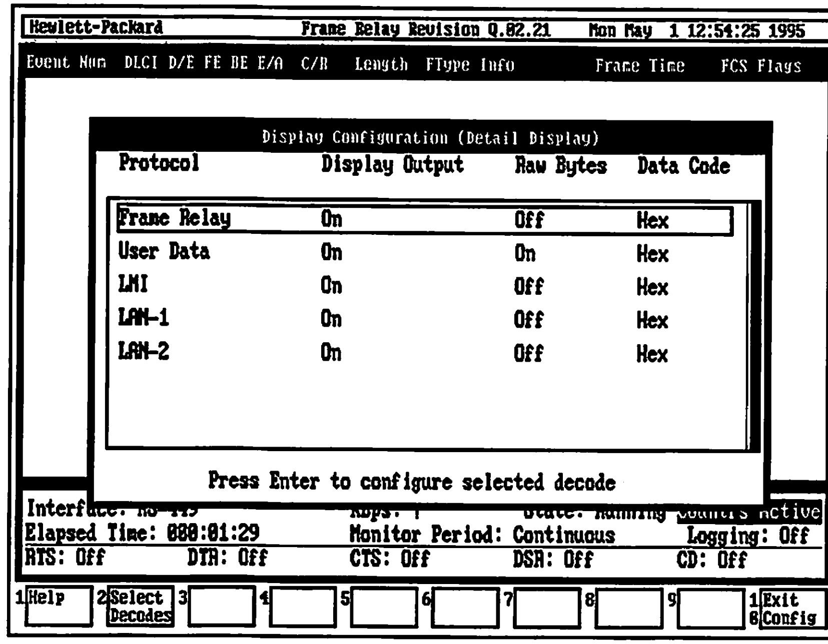


Figure 4-7: Display Configuration Screen

5. We want to load the X.25 Layer 3 decode and the X.25 Layer 2 decode, so press **F2** (Select Decodes).

6. Using the arrow keys, highlight **X25L3.DEC**, and press **ENTER.**

7. Using the arrow keys, highlight **X25L2.DEC**, and press **ENTER.**

8. Press **F10** (OK) to load these two additional decodes. Figure 4-8 shows how the Display Configuration screen looks with the additional X.25 decodes loaded.

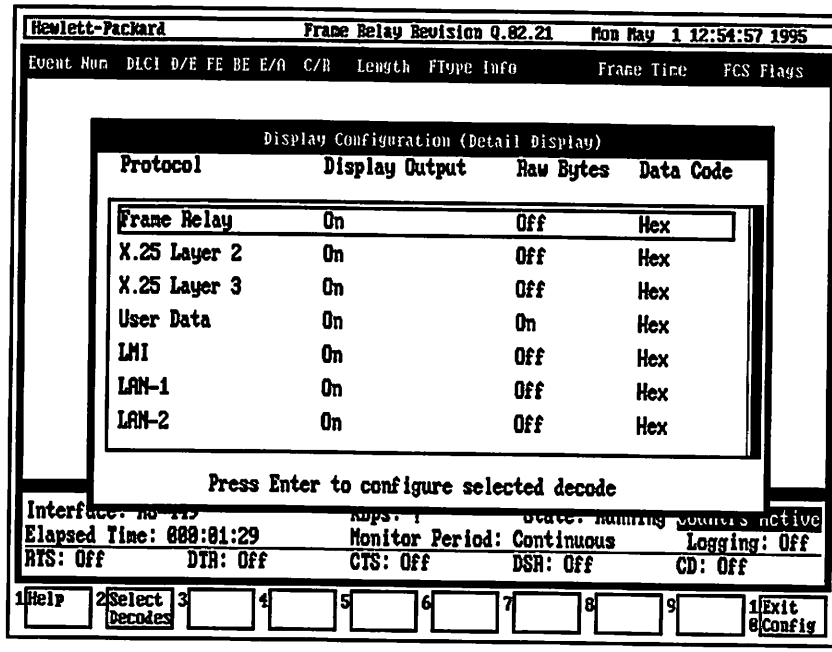


Figure 4-8: Display Configuration with X.25 Decodes Loaded

9. We must now set the new linkages for the protocol stack. With Frame Relay highlighted, press **ENTER**. The Decode Configuration Menu for Frame Relay opens.

10. With the Down Arrow key, highlight the **Next Protocol** field.

11. Change the **Next Protocol** field to X.25 Layer 2 as shown in Figure 4-9.

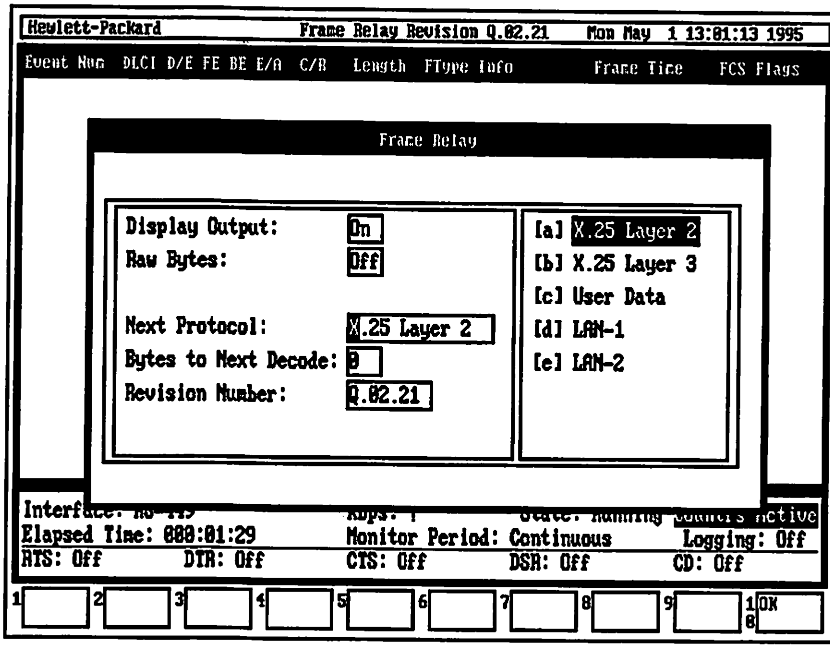


Figure 4-9: Frame Relay Decode Configuration Menu

12. Press **F10** (OK). X.25 Layer 2 now understands that X.25 Layer 3 is the Next Protocol, but X.25 Layer 3 needs to be reconfigured to pass the decoding to LAN-1.

13. In the Display Configuration screen, highlight X.25 Layer 3 and press **ENTER**.

14. Highlight the **Next Protocol** field and change it to LAN-1 as shown in Figure 4-10.

•

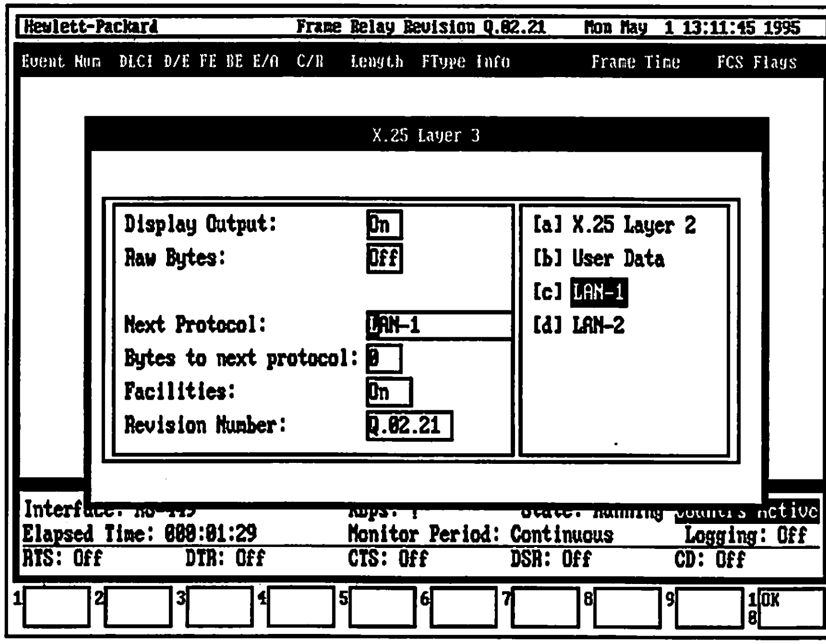


Figure 4-10: X.25 Layer 3 Decode Configuration

15. Press **F10** (OK). The Internet Advisor is now configured to decode LAN traffic encapsulated in X.25, encapsulated in Frame Relay.

Decode Utilities

When monitoring is stopped, the **F3** (Decode Utils) softkey is available. Pressing this softkey provides a new set of softkeys:

F1 (Help)	Accesses the Internet Advisor's Help System.
F2 (Print Data)	Lets you specify a range of events to print in the same format as the configured decode. Print Data requires a graphics mode printer and produces a continuous "screen dump." Select PC Decodes, from the Main Group screen, to get an ASCII printout of data.
F3 (Save Data)	Lets you specify a range of events to save to a file which has a `.DAT` extension. The recording format is specific to the Internet Advisor; this format cannot be used by other applications. If you save events to a file, you can later view and analyze them using View Data File. Refer to "Viewing Data Files," later in this chapter, for more information.
F4 (Search Data)	Lets you configure searches for strings of data or types of frames. Refer to the next section "Searching for Specific Data" for more information.
F5 (Active Region)	Lets you define a limited range of events for analysis.
F6 (Relativ Time)	Lets you define a particular event in the buffer to be time zero. Events before time zero have negative time stamps.
F7 (Real Time)	Sets the event time to real-time clock mode (HH:MM:SS.SSSSS). Real-time clock resolution is 10 microseconds, but the first time stamp is based on the nearest second of the DOS clock.
F8 (Delta Time)	Lets you see the time between events with a resolution of 10 microseconds.
F10 (Exit Utils)	Exits the Decode Utilities.

Searching for Specific Data

When you have data in the capture buffer, either because you just captured it or because you loaded a previously-saved data file, you can repeatedly analyze the data. For example, you can define a Search Setup that lets you search the data to find particular types of frames and frame attributes or particular string patterns in the data. The frames types you can search on are protocol specific.

To access the searching capability, from either the Detailed Decode display or the Summary Decode display, press **F3** (Decode Utils) and then **F4** (Search Data). These are the search softkeys:

F2 (Search Setup)	Opens the Search Setup screen from which you can define the search parameters.
F3 (Search Forward)	Performs the defined search from the present position in the capture buffer to the end of the buffer. All frames matching the search parameters are marked with an asterisk (*) before the word `Event`.
F4 (Clear Marks)	Clears the marks from all marked frames.
F5 (Show Marked)	Displays only marked frames.
F10 (Exit Search)	Exits the search facility and returns to Decode Utilities.

Defining a Search Setup

To define a Search Setup, use the procedure below:

1. In either the Detailed or the Summary Decode display, press **F3** (Decode Utils).

2. Press **F4** (Search Data).

3. Press **F2** (Search Setup). This opens the Search Setup screen in which you can specify whether searching is on or off for a protocol layer and for a string search. Figure 4-11 shows an example of the Search Setup screen for Frame Relay tests.

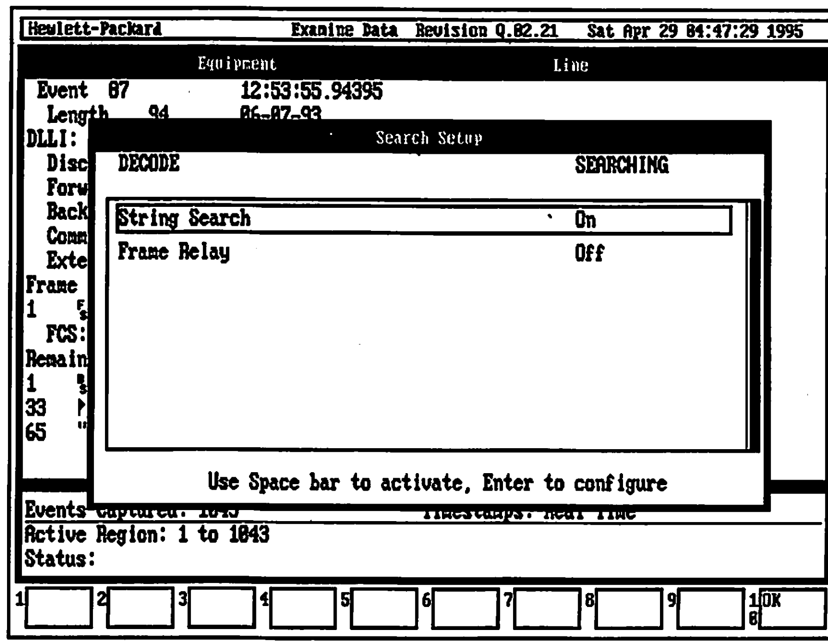


Figure 4-11: Search Setup Screen

4. To specify layer 2 search parameters, highlight the layer 2 decode and press **ENTER**. This opens a screen in which you can specify the layer 2 search parameters. Figure 4-12 shows an example screen for Frame Relay.

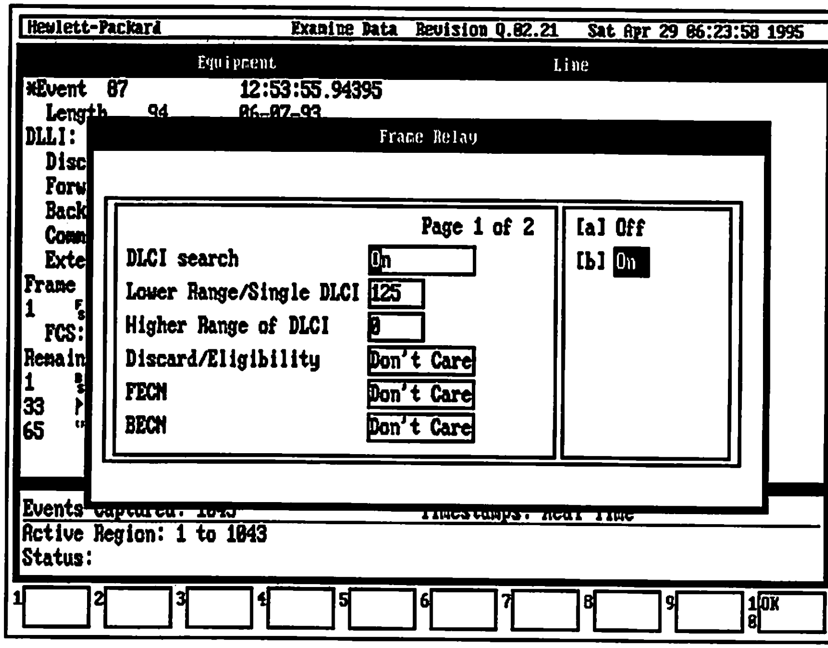


Figure 4-12: Frame Relay Search Setup Screen

5. Make your layer 2 frame search selections.

NOTE

The available search parameters are protocol specific. That is, the fields and choices you see depend on what the layer 2 protocol is. The available choices for Frame Relay, BOP, and X.25 are described in separate sections which follow this procedure. Frame search is not available for SMDS traffic; for SMDS, only string search is allowed.

6. After making your selections, press **F10** (OK) to return to the Search Setup screen.

7. With the layer 2 decode still highlighted, press the Spacebar to turn layer 2 searching on.

8. If you want to define a string search, highlight **String Search** and press **ENTER**. The String Search Menu opens. The search string can be up to 1016 bytes long. Figure 4-13 shows an example of a search string entered as text.

9. To enter the search string in hex, press **CTRL** and **H** simultaneously, and then enter the hex string.

   or

To enter the search string as text, press **CTRL** and **T** simultaneously, and then enter the text string.

   or

To enter "don't care" in certain byte positions, press **CTRL** and **D** simultaneously.

   or

To use a string that is in a user-defined message file as the search string, press **ENTER** and then enter the path and file name of the file along with its .UDM extension. Alternatively, you can press **ENTER** to browse the disk to look for the file.

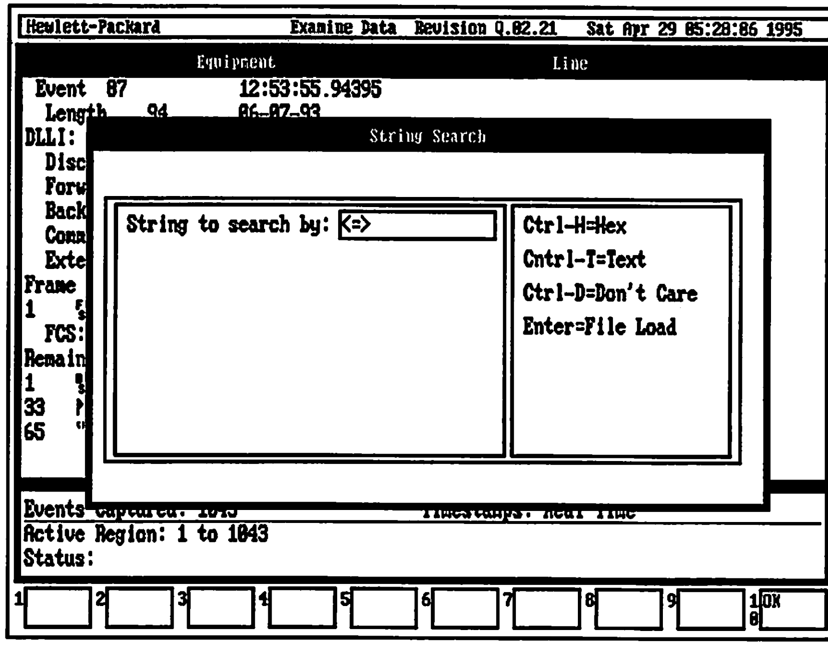


Figure 4-13: String Search

10. Press **F10** (OK) when you are done defining the search string.

11. With **Search String** still highlighted, press the Spacebar to turn string searching on.

12. Press **F10** (OK) again to return to the Decode display.

13. Press **F3** (Search Forward) to search forward through the data for frames and/or strings that match your search criteria. A counter appears to tell you how the search is progressing. Any frames that match are marked with an asterisk (*) before the event number.

14. To display only the marked frames, press **F5** (Show Marked). Figure 4-14 shows an example of two marked frames, events number 87 and 90.

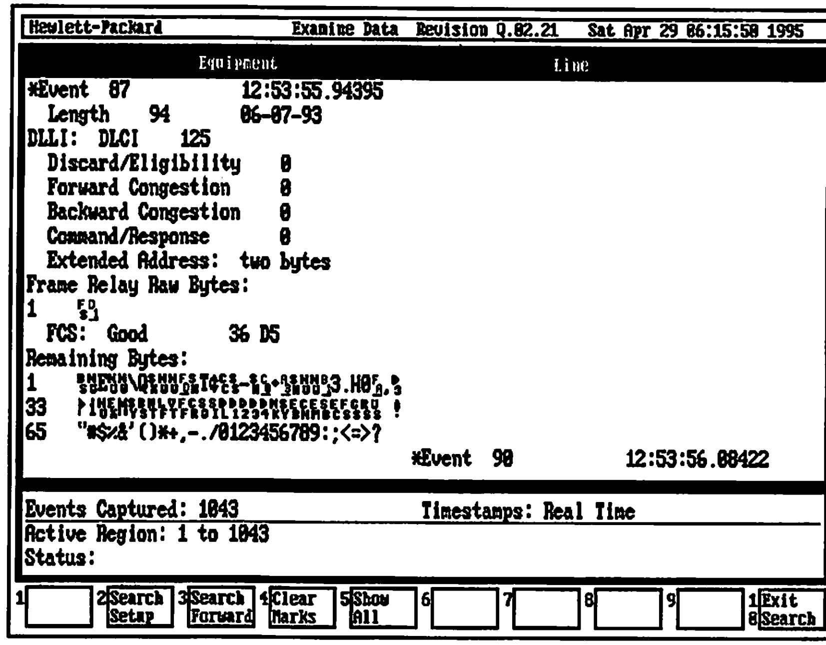


Figure 4-14: Displaying Marked Frames Only

15. To return to the regular display mode in which all frames are shown, press **F5** (Show All).

16. To clear the marks, press **F4** (Clear Marks).

Frame Relay Search Parameters

The fields in the Frame Relay Search Setup screen are described below:

DLCI Search - Tells the Internet Advisor to mark frames with the specified DLCI. The choices for this field are:

Off Ignore DLCI.

On	Mark frames between the DLCI range specified in the **Lower Range/Single DLCI** and **Higher Range of DLCI** fields. If you want to look for DLCIs in a range, indicate the lower limit DLCI (from `0` to `1024`) in the **Lower Range/Single DLCI** field, and enter the upper limit DLCI (from `0` to `1024`) in the **Higher Range of DLCI** field. To identify traffic to and from a single DLCI, enter its DLCI number in **Lower Range/Single DLCI** and enter `0` in **Higher Range of DLCI.**

Discard/Eligibility, FECN, BECN, Command/Response, and Address Extension - The choices for these fields are:

0

1

Don't Care

FCS - Tells the Internet Advisor to mark frames with the specified Frame Check Sequence value. The choices for this field are:

Good	Mark frames with good Frame Check Sequence.
Bad	Mark frames with bad Frame Check Sequence.
Abort	Mark frames ending in Abort Sequence.
Don't Care	Ignore the FCS value.

BOP and X.25 Search Parameters

The fields in the BOP and X.25 Search Setup screens are described below:

Frame Type - Tells the Internet Advisor to mark frames of the specified frame type. The choices are:

Don't Care	DISC/RD
User Defined	UA
Information	UI
Supervisory	UP
Unnumbered	RSET
RR	XID
RNR	SABME
REJ	TEST
SREJ	FRMR
SNRM	SNRME
SARM/DM	SARME
SABM	BCN
SIM/RIM	CFGR

If the **Frame Type** field is set to User Defined, then a hexadecimal byte value must be entered in the **User Def Frame Type** field.

Address Type - Tells the Internet Advisor to mark frames of the specified address type. The choices are:

01
03
FF
User Defined
Don't Care

If the **Address Type** field is set to User Defined, then a hexadecimal byte value must be entered in the **Address (hex)** field.

Poll/Final - Tells the Internet Advisor to mark frames in which the Poll/Final bit matches the specified value. The choices are:

0
1
Don't Care

FCS - Tells the Internet Advisor to mark frames with the specified Frame Check Sequence value. The choices for this field are:

Good	Mark frames with good Frame Check Sequence.
Bad	Mark frames with bad Frame Check Sequence.
Abort	Mark frames ending in Abort Sequence.
Don't Care	Ignore the FCS value.

Statistics

In addition to decoding data, another objective of monitoring is to make statistical measurements. The Internet Advisor provides a variety of statistics including the following:

- Link Level Statistics (which include link level counts, link level utilization, and link level throughput) are provided in the Statistics and Counters Page 1 of 2 screen.
- Counts of such things as specific frame types (if any of the filters/counters have been configured) are shown in the Statistics and Counters Page 2 of 2 screen.
- LCN (Logical Channel Number) Statistics (for X.25 only) are provided in the LCN Statistics screen.
- DLCI (Data Link Connection Identifier) Statistics (for Frame Relay only) are provided in the DLCI Statistics screen.
- Line Status information is provided in the Current Line Status (page 1) screen and the Line Status History (page 2) screen.
- Signalling bit information (for T1 only) is provided in the Line Status (page 3) screen.

Link Level Statistics and Counters

Figure 4-15 shows the first Statistics and Counters screen for a T1 link. This screen shows the basic T1 statistical measurements. Refer to Appendix B, “Supplied Tests,” for a complete listing of the statistical measurements available for all interfaces. Also refer to Appendix D, “T1 and E1 Technology Overview,” for an explanation of the framing counts.

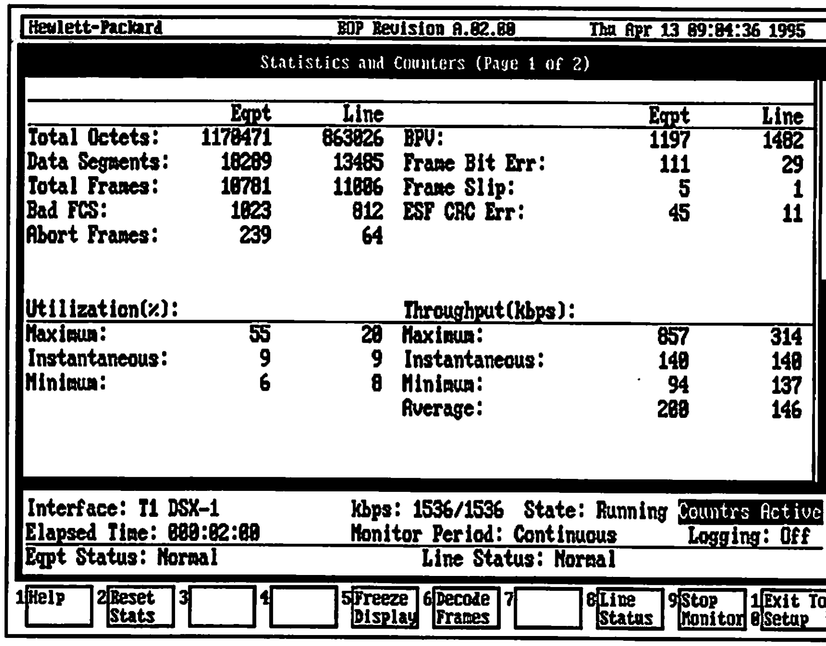


Figure 4-15: Statistics and Counters (Page 1 of 2)

In the Statistics and Counters screen, data is shown for both the Equipment (DTE) and the Line (DCE) channels. Measurements start with the beginning of the test and can be reset by pressing **F2** (Reset Stats).

Link Level Counts - The following are the link level counts statistics:

Total Octets	Total octets excluding flags (^7E) or idles (^FF).
Data Segments	An Internet Advisor buffer data segment is 64 bytes. Thus, Total Octets / 64 (rounded up) is the number of data segments in use.
Total Frames	The sum of all frames with good, bad, or abort Frame Check Sequences. The frame length can be from 1 bit to 32 Kilobytes.

Bad FCS	Number of frames with a bad Frame Check Sequence.
Abort Frames	Number of frame with an abort sequence ("0" followed by seven or more "1s".)
Short Frames	This is shown only for Frame Relay tests. It is the number of frames (Good, Bad, and Abort) with fewer than four octets between flags.

Utilization(%) - Utilization percentage equals 100 times Total Octets times 8 divided by the measured data rate. It is updated once per second.

Maximum	Peak utilization since the beginning of the test or since **F2** (Reset Stats) was last pressed.
Instantaneous	Utilization in the latest sampling period (one second).
Minimum	Minimum utilization since the beginning of the test or since **F2** (Reset Stats) was last pressed.

Throughput (kbps) - This equals Total Octets times 8 per second. It is updated once per second.

Maximum	Peak throughput since the beginning of the test or since **F2** (Reset Stats) was last pressed.
Instantaneous	Throughput in the latest sampling period (one second).
Minimum	Minimum throughput since the beginning of the test or since **F2** (Reset Stats) was last pressed.
Average	Average throughput since the beginning of the test or since **F2** (Reset Stats) was last pressed.

If the **Interface Type** field of the Interface Setup Menu is set for a T1 interface, four additional T1 statistics are included:

BPV	This shows the number of Bipolar Violations. It is a running count of the number of times that "mark" pulses fail to alternate polarity (Alternate Mark Inversion). This count does not include B8ZS patterns if the **Line Code** field in the Interface Setup Menu is set to B8ZS.
Frame Bit Err	Framing Bit Error is a running count of the number of times errors have occurred in the framing pattern.
Frame Slip	This shows when bits have been gained or lost due to differences in clocking between two systems. Even between end users with independent data clocking, Frame Slips should occur only once every several hours. Frame Slips occurring more often indicates serious configurational difficulties.
ESF CRC Err	The Extended Super Frame Cyclic Redundancy Check Error is a "built-in" T1 line-quality indicator. It is a running count of the CRC errors. This is available only when the **Framing Type** field in the Interface Setup Menu is set to ESF.

If the **Interface Type** field of the Interface Setup Menu is set for an E1 interface, three additional E1 statistics are included:

CodeViolation	This counts shows the number of Bipolar Violations. It is a running count of the number of times that "mark" pulses fail to alternate polarity (Alternate Mark Inversion). This count does not include HDB3 patterns if the **Line Code** field in the Interface Setup Menu is set to HDB3.
FAS Err	Framing Pattern Error is a running count of the number of times errors have occurred in the framing pattern.
CRC-4 Err	E1 Cyclic Redundancy Check Error is a "built-in" E1 line-quality indicator. It is a running count of the CRC errors. It is available only when the **Framing** field in the Interface Setup Menu is set to With CRC-4.

These are the Statistics and Counters softkeys:

F1 (Help)	Invokes the Internet Advisor's Help system.
F2 (Reset Stats)	Only appears after monitoring has been started. Zeroes all counters and leaves them running.
F5 (Freeze Display)	Only appears after monitoring has been started. Pauses the upper window of the display.
F5 (Cont. Display)	Resumes normal upper window operation.
F6 (Decode Frames)	Returns to the decode mode of display.
F7 (LCN Stats)	Available for X.25 only. Presents statistics on a "per Combined LCN basis." Refer to the section "LCN Statistics."
F7 (DLCI Stats)	Available for Frame Relay only. Presents statistics on a "per DLCI basis." Refer to the section "DLCI Statistics."
F8 (Line Status)	Available for T1 and E1 only. Presents a qualitative view of the link. Refer to the following "Line Status" section.
F9 (Start Monitor)	Begins the monitoring process.
F9 (Stop Monitor)	Stops the monitoring process.

Pressing **PgDn** or the Down Arrow from Page 1 of the Statistics and Counters screen displays Page 2 of the Statistics and Counters screen. What you see on Page 2 depends on how (or if) you have configured the Internet Advisor's user-definable filter/counters (described in chapter 3, "Configuring the Internet Advisor"). In Figure 4-16, the user-defined counters have been configured to provide some relevant TCP/IP counts. The Internet Advisor comes with many preconfigured tests (described in Appendix B, "Supplied Tests") in which the counters are preconfigured.

NOTE

The counters/filters are implemented in programmable hardware. In the preconfigured tests, they are set to count specific data patterns based on standard usage. Non-standard variations in protocols or usage may defeat a counter/filter's recognition ability.

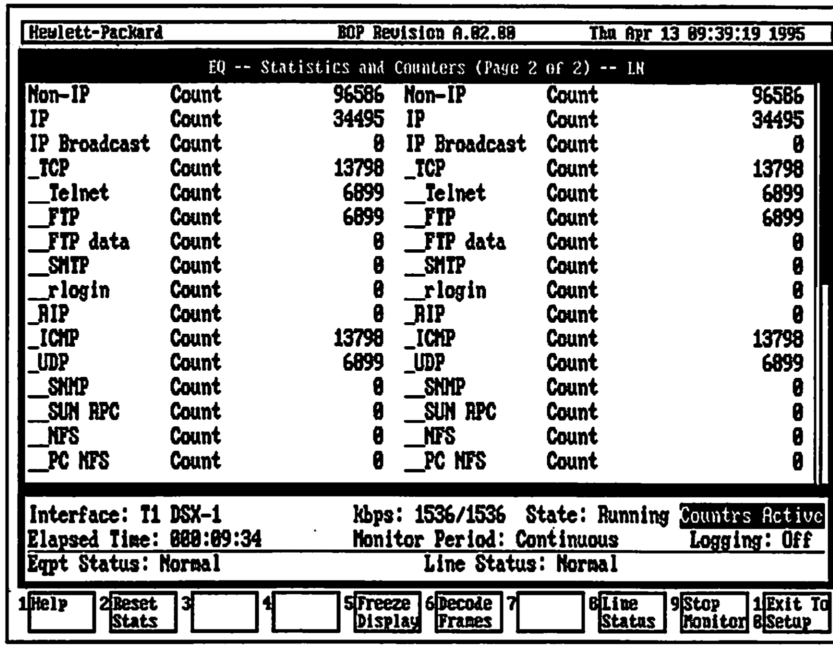


Figure 4-16: Statistics and Counters (Page 2 of 2)

Press **PgUp** or Up Arrow to go back to Page 1 of the Statistics and Counters screen.

LCN Statistics

If the Internet Advisor is configured for X.25 operation, pressing **F7** (LCN Stats) provides individual statistics of up to 30 Combined Logical Channel Numbers.

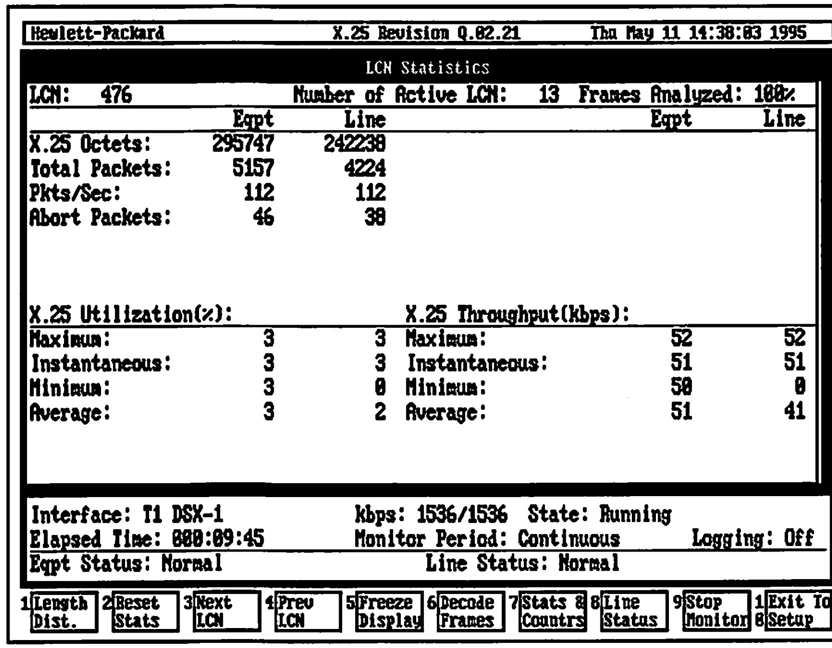


Figure 4-17: X.25 LCN Statistics Screen

These LCN-specific softkeys are available in the LCN Statistics screen:

F1 (Length Dist.) Opens the Data Packet Length Distribution screen, which shows the distribution of packet sizes on the link for all packets. See Figure 4-18 for an example.

F3 (Next LCN) Lets you select which of the first thirty identified LCNs to view.

F4 (Prev LCN) Lets you move backward in your LCN selection.

The top line of the LCN Statistics screen indicates which LCN is being examined (the Active LCN) and how many LCNs have been found to be active on the link. High utilization coupled with short transmissions may force the Internet Advisor to function in a sampling mode.

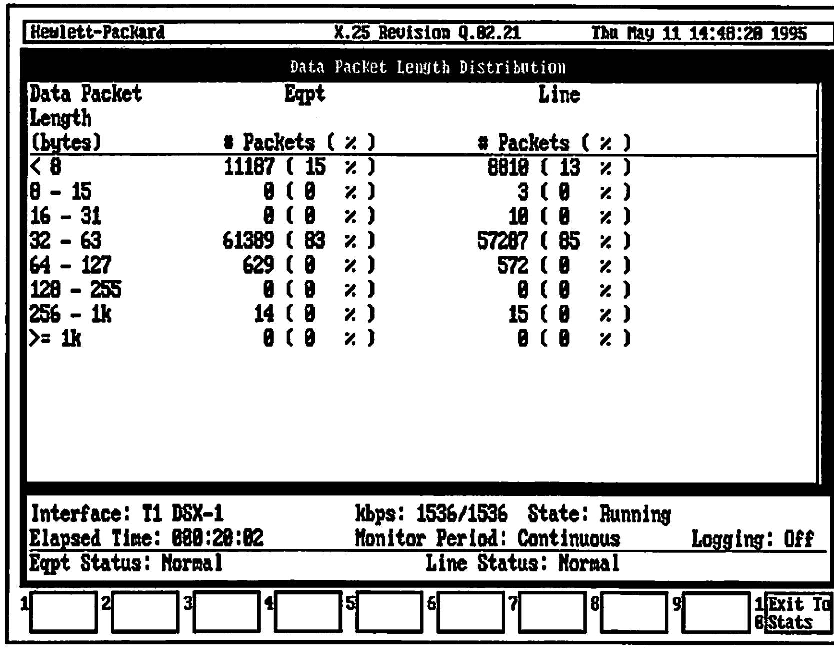


Figure 4-18: Data Packet Length Distribution Screen

The Data Packet Length Distribution screen gives a view of all X.25 traffic on the link sorted and presented by the length of the data field. All LCNs are included in this measurement and both Equipment (DTE) and Line (DCE) data are shown. The ranges in bytes are: Less than 8; 8 to 15; 16 to 31; 32 to 63; 64 to 127; 128 to 255; 256 to 1023; 1024 and greater. Each measured value is also expressed as a percentage of the total.

The only softkey available in this screen is **F10** (Exit To Stats), which returns you to the LCN Statistics screen.

DLCI Statistics

If the Internet Advisor is configured for Frame Relay operation, pressing **F7** (DLCI Stats) opens the DLCI Statistics screen.

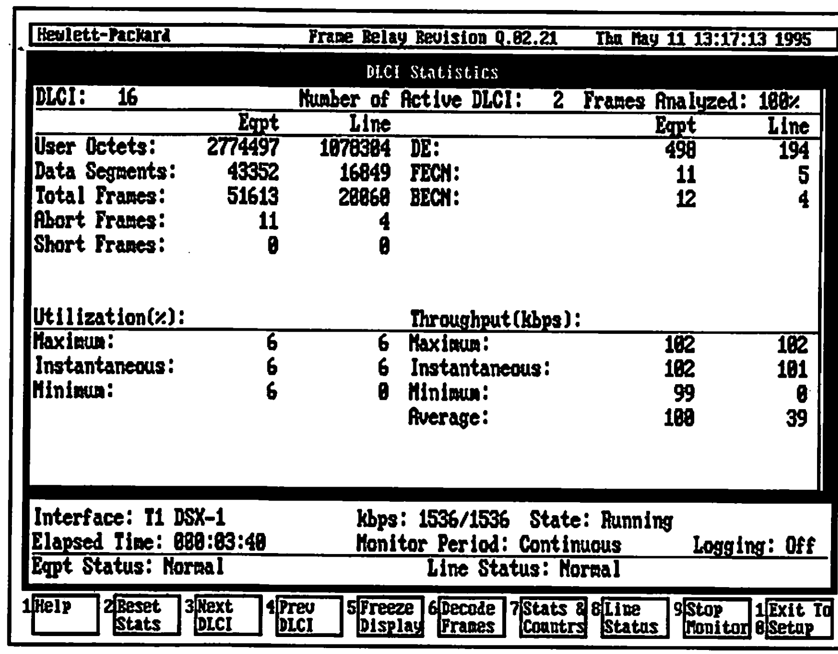


Figure 4-19: DLCI Statistics Screen

These DLCI-specific softkeys are available in the DLCI Statistics screen:

F3 (Next DLCI) Lets you select which of the first thirty identified DLCIs to view.

F4 (Prev DLCI) Lets you move backward in your DLCI selection.

The top line of the display indicates which DLCI is being examined (the Active DLCI) and how many DLCIs have been found to be active on the link. High utilization coupled with short transmissions may force the Internet Advisor to function in a sampling mode.

Line Status

When the active interface is either T1 or E1, Statistics and Counters offers the **F8** (Line Status) softkey. Pressing this softkey takes you to Page 1 of the Line Status screen, which gives a quick view of the current configuration and status of the T1 or E1 link under test. Figure 4-20 shows Line Status (Page 1 of 2) for a T1 link.

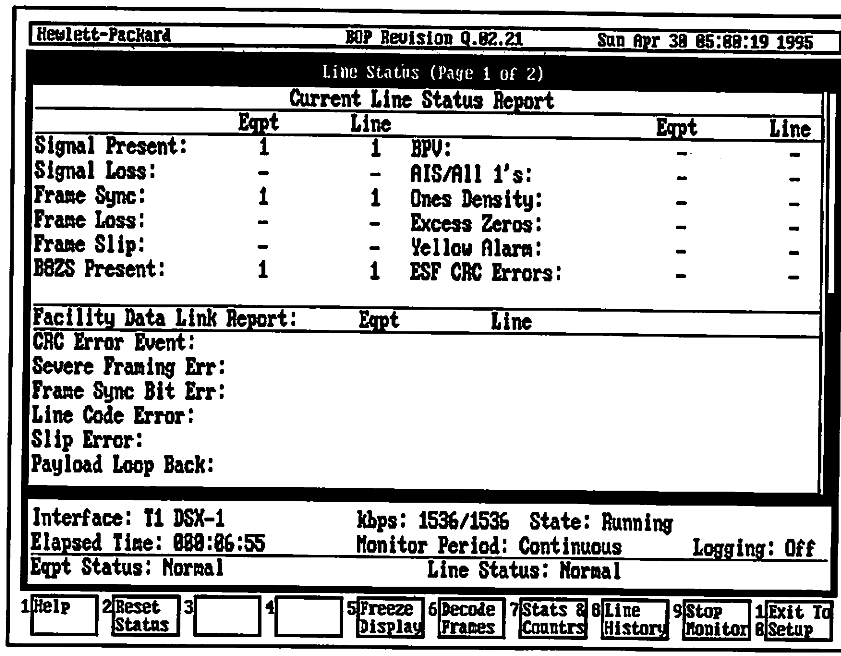


Figure 4-20: Current T1 Line Status (Page 1 of 2 or Page 1 of 3)

In the Current Line Status display, a 1 indicates that a condition has occurred in the most recent sampling period. A "–" indicates that the condition has not occurred. If you have a color display, an errored or problem condition is indicated by a white 1 in a red box and normal operating condition is indicated by a white 1 in a green box. T1 Line Status indicates:

Signal Present	BPV
Signal Loss	AIS/All 1's
Frame Sync	One's Density
Frame Loss	Excess Zeros
Frame Slip	Yellow Alarm
B8ZS Present (if configured for B8ZS)	ESF CRC Errors (if configured for ESF)

In the case of a T1 interface configured for ESF, there is also the Facilities Data Link Report for both Equipment and Line. The occurrence of FDL messages is shown. These messages are generated by T1 ESF devices to report occurrences of errors. They are transmitted on the 4 kbps ESF data channel. The recognition of these messages follows the T1.403 FDL recommendation.

The Facilities Data Link Report indicates:

CRC Error Event	Line Code Error
Severe Framing Err	Slip Error
Frame Sync Bit Err	Payload Loopback

Refer to Appendix D, "T1 and E1 Technology Overview," for definitions of these T1 terms.

Figure 4-21 shows Line Status (Page 1 of 2) for an E1 link.

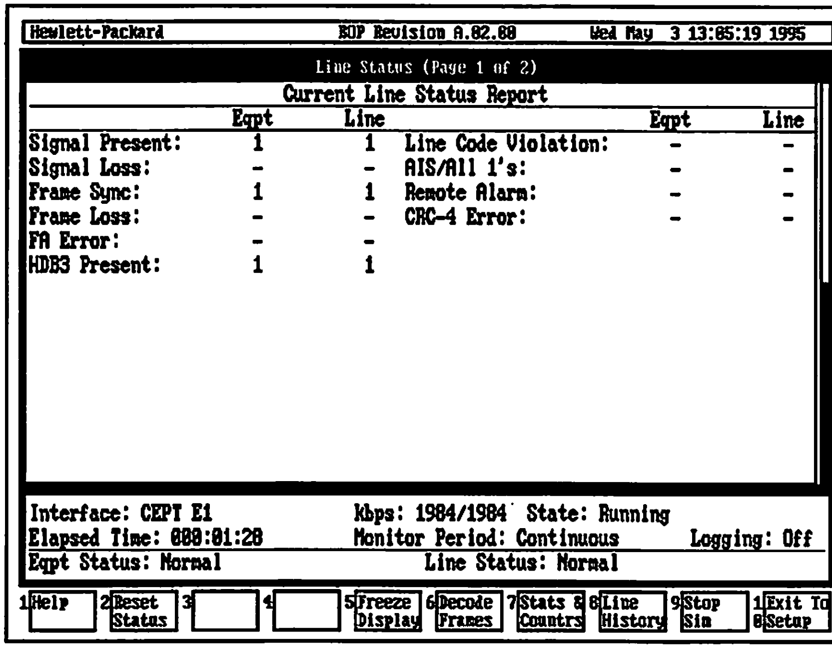


Figure 4-21: E1 Line History (Page 1 of 2)

E1 Line Status indicates:

Signal Present	Line Code Violation
Signal Loss	AIS/All 1's
Frame Sync	Remote Alarm
Frame Loss	CRC-4 Errors (if configured for ESF)
FA Error	
HDB3 Present (if configured for HDB3)	

See Appendix D, "T1 and E1 Technology Overview," for definitions of these E1 terms.

Pressing **F8** (Line History) (or **PgDn** or the Down Arrow) displays Page 2, which is the Line Status History Report. Figure 4-22 shows an example of this screen for T1 and Figure 4-23 shows an example of this screen for E1.

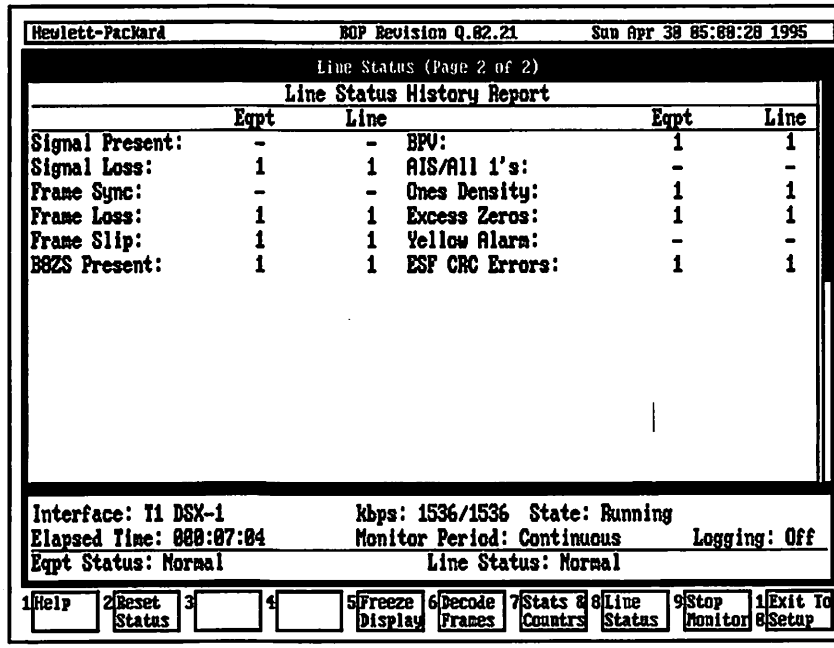


Figure 4-22: T1 Line History Status (Page 2 of 2 or Page 2 of 3)

For both T1 and E1 Line History Status, a `1` indicates a condition has occurred in the "past," that is, since the beginning of the test or since the last time **F2** (Reset Status) was pressed. Once again, a "-" indicates that the condition has not occurred.

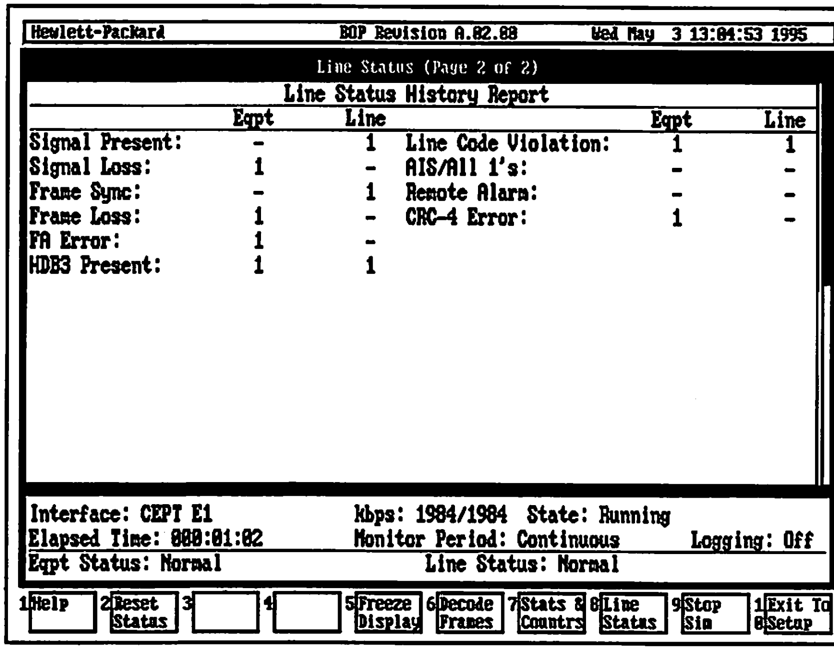
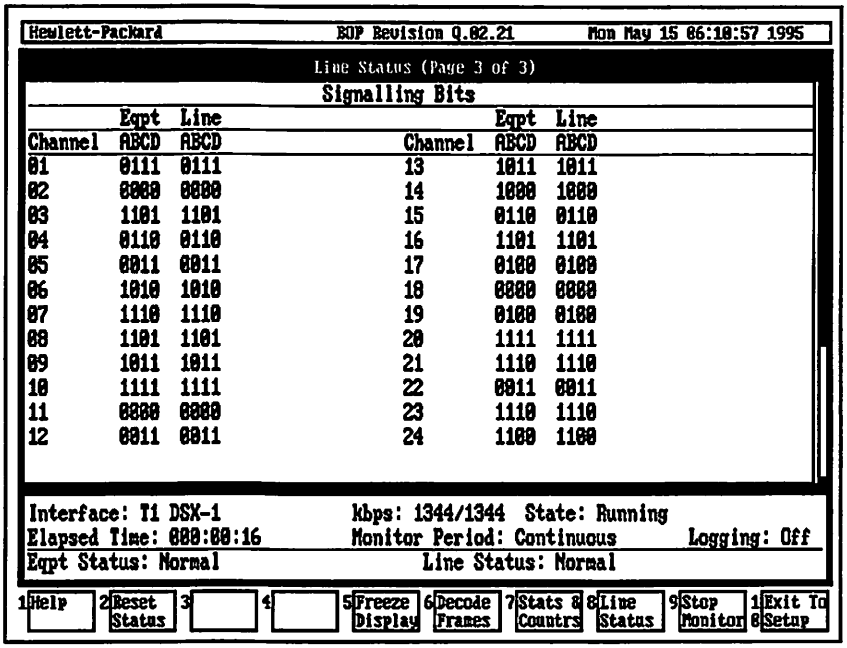


Figure 4-23: E1 Line History Status (Page 2 of 2)

In the case of a T1 link configured for 56 kbps Fractional or 56 kbps Full Frame channels with either ESF or D4 framing, there is a third page of Line Status available, which can be accessed by pressing **F8**, **PgDn**, or Down Arrow from Page 2. Page 3 shows 24 channels of signalling bits. When configured for D4 framing, only the A and B bits are available. When configured for ESF framing, A, B, C, and D bits are shown. Figure 4-24 shows an example.

NOTE

Refer to the section “Log ABCD Bits (for T1 Only)” in Appendix B, “Supplied Tests,” for information on logging ABCD bits to a file.



Hewlett-Packard BOP Revision Q.02.21 Mon May 15 06:10:57 1995

Line Status (Page 3 of 3)

Signalling Bits

Channel	Eqpt ABCD	Line ABCD	Channel	Eqpt ABCD	Line ABCD
01	0111	0111	13	1011	1011
02	0000	0000	14	1000	1000
03	1101	1101	15	0110	0110
04	0110	0110	16	1101	1101
05	0011	0011	17	0100	0100
06	1010	1010	18	0000	0000
07	1110	1110	19	0100	0100
08	1101	1101	20	1111	1111
09	1011	1011	21	1110	1110
10	1111	1111	22	0011	0011
11	0000	0000	23	1110	1110
12	0011	0011	24	1100	1100

Interface: T1 DSX-1 Kbps: 1344/1344 State: Running
Elapsed Time: 000:00:16 Monitor Period: Continuous Logging: Off
Eqpt Status: Normal Line Status: Normal

1 Help | 2 Reset Status | 3 | 4 | 5 Freeze Display | 6 Decode Frames | 7 Stats & Countrs | 8 Line Status | 9 Stop Monitor | 10 Exit To Setup

Figure 4-24: T1 Line Status (Page 3 of 3) Signalling Bits

Documenting Data

The High Speed Internet Advisor gives you several options for documenting the data on your network:

- Save the data in a file: When you save data using the Decode Utilities, you can view it later using View Data File. Refer to the "Decode Utilities" and "Viewing Data Files" sections of this chapter for more information.

- Print the decode information: You can print all decode events or a subset of events directly to a printer. Refer to the "Decode Utilities" section of this chapter for more information.

- Log statistics to a file: You can turn on statistics logging to save network statistics and counter information to a file. You can then use View Stats File for viewing the file. You can also export a Stats File to a comma-separated variable format for use with a spreadsheet. Refer to the "Statistics" and "Exporting Statistics" sections of this chapter for more information.

- Saving to an ASCII file: You can use PC Decodes in the top level of the Toolkit to convert an Internet Advisor proprietary format file to an ASCII format file. After changing the data directory to locate your file, select the `.DAT` file and use the Convert to Events key to get a `.EVE` file. Select the `.EVE` file, then press the Select Decodes key to specify the WAN decode. Press **F5** (Examine Data) twice, then go to Special Functions, and then to Print Events. You have the option of printing all or a subset of the events to a printer or to a file.

- For LAN Over WAN decodes: You can use the `XLATE` program on the HP LAN Advisor to translate the LAN decodes from WAN Internet Advisor format to LAN Internet Advisor format. You can then load that file into the LAN Internet Advisor and run tests and decodes on the data. The `XLATE` program is in the `UTILS` directory of the LAN Internet Advisor.

- Use the WAN Internet Reporter: If you purchased the HP WAN Internet Reporter, you can graph and chart high-speed information in various combinations and formats.

Viewing Data Files

In the center column of the Main Group\High Speed Analyzr screen is a page icon (▤) labeled **View Data File,** which lets you view previously stored data files (*.DAT).

To view a previously stored data file do the following:

1. Select **View Data File** in the Main Group\High Speed Analyzr screen. The Examine Data Application Menu opens in which you can enter the name of the data file you want to view.

2. If you know the path and the name of the file you want to view, type it into the **Drive/File Selection** field along with the `.DAT` extension. Several example data files come with the Internet Advisor. They are located in the `\HPTOOLS\DATA` directory.

   or

   If you don't know the file name, press **ENTER** to browse the disk to search for the file.

   Once you have specified a path and file name, the bottom window reports the file's status. An example is shown in Figure 4-25.

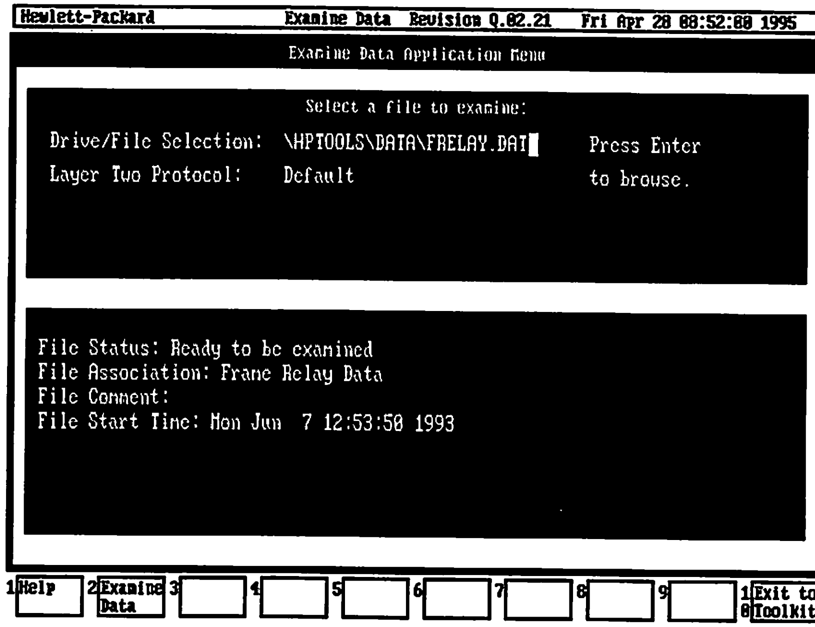


Figure 4-25: Examine Data Application Menu

3. Press **F2** (Examine Data). The Interface Setup Menu appears. You cannot make selections in this screen; it is displayed only to show you how the Internet Advisor was configured when the data was captured. Figure 4-26 shows an example.

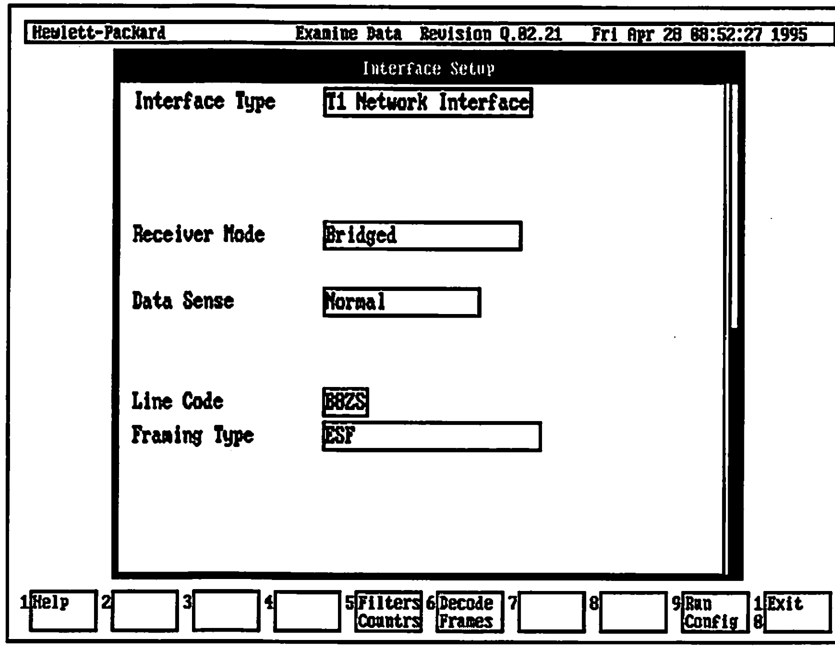
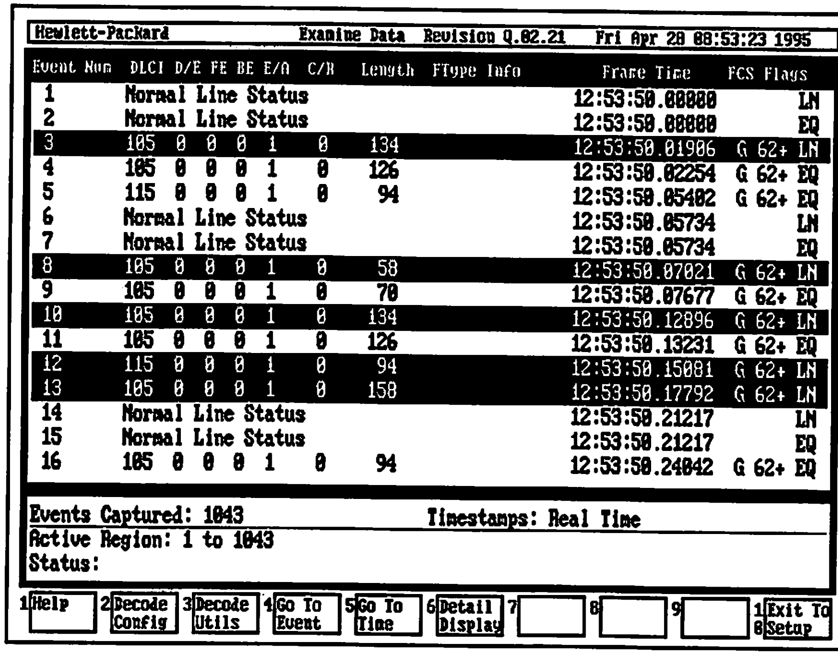


Figure 4-26: Interface Setup at the Time of Data Capture

4. If you want information on what filter/counters were used when the data was captured, press **F5** (Filters Countrs). Once again, you cannot make selections in this screen; it is displayed only to show you how the filters and counters were configured when the data was captured.

5. Press **F6** (Decode Frames) to view the data. The data is displayed in the detailed format. An example is shown in Figure 4-27.



Hewlett-Packard	Examine Data	Revision Q.02.21	Fri Apr 28 08:53:23 1995

Event Num	DLCI	D/E	FE	BE	E/A	C/R	Length	FType Info	Frame Time	FCS	Flags
1	Normal Line Status								12:53:50.00000		LN
2	Normal Line Status								12:53:50.00000		EQ
3	105	0	0	0	1	0	134		12:53:50.01986	G	62+ LN
4	105	0	0	0	1	0	126		12:53:50.02254	G	62+ EQ
5	115	0	0	0	1	0	94		12:53:50.05402	G	62+ EQ
6	Normal Line Status								12:53:50.05734		LN
7	Normal Line Status								12:53:50.05734		EQ
8	105	0	0	0	1	0	58		12:53:50.07021	G	62+ LN
9	105	0	0	0	1	0	70		12:53:50.07677	G	62+ EQ
10	105	0	0	0	1	0	134		12:53:50.12896	G	62+ LN
11	105	0	0	0	1	0	126		12:53:50.13231	G	62+ EQ
12	115	0	0	0	1	0	94		12:53:50.15081	G	62+ LN
13	105	0	0	0	1	0	158		12:53:50.17792	G	62+ LN
14	Normal Line Status								12:53:50.21217		LN
15	Normal Line Status								12:53:50.21217		EQ
16	105	0	0	0	1	0	94		12:53:50.24042	G	62+ EQ

Events Captured: 1043 Timestamps: Real Time
Active Region: 1 to 1043
Status:

1 Help | 2 Decode Config | 3 Decode Utils | 4 Go To Event | 5 Go To Time | 6 Detail Display | 7 | 8 | 9 | 10 Exit To Setup

Figure 4-27: Decoding Previously Stored Data

At this point you have all the capabilities of examining regular buffer data. For example, you can define a search setup to search for specific types of frames.

Viewing Statistics Logs

In the center column of the Main Group\High Speed Analyzr screen is a page icon ( ) labeled **View Stats Log**, which lets you view previously stored statistics log files (*.LOG). Stats log files are created by setting the **Statistics Logging** field in the Run Configuration Menu to On. Refer to the "Run Configuration" section in chapter 3, "Configuring the Internet Advisor."

To view a previously stored statistics log file do the following:

1. Select **View Stats Log** in the Main Group\High Speed Analyzr screen. The Examine Data Application Menu opens in which you can enter the name of the log file you want to view.

2. If you know the path and the name of the file you want to view, type it into the **Drive/File Selection** field along with the .LOG extension.

   or

   If you don't know the file name, press **ENTER** to browse the disk to search for the file.

   Once you have specified a path and file name, the bottom window reports the file's status. An example is shown in Figure 4-28.

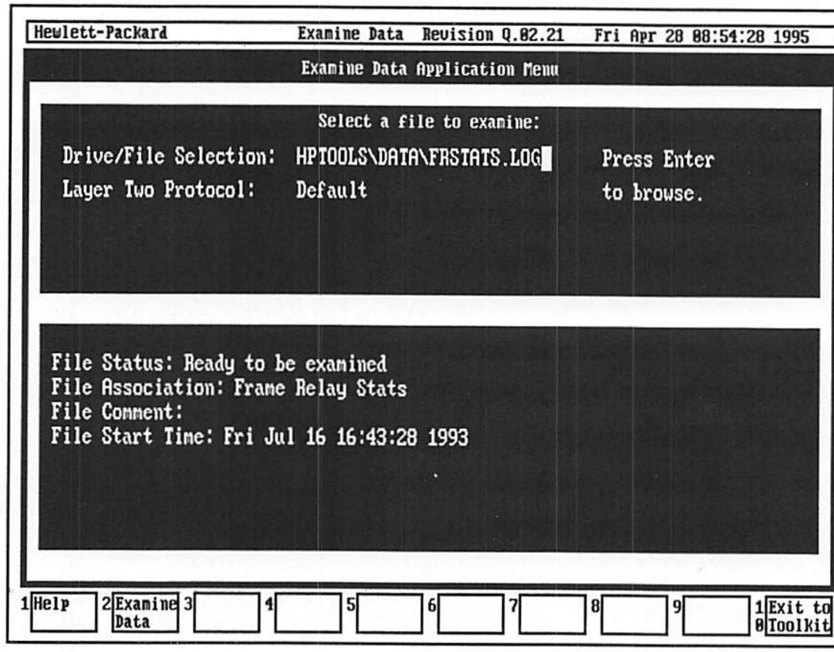


Figure 4-28: Examine Data Application Menu

3. Press **F2** (Examine Data). The Interface Setup Menu appears. You cannot make selections in this screen; it is displayed only to show you how the Internet Advisor was configured when the stats were logged. Figure 4-29 shows an example.

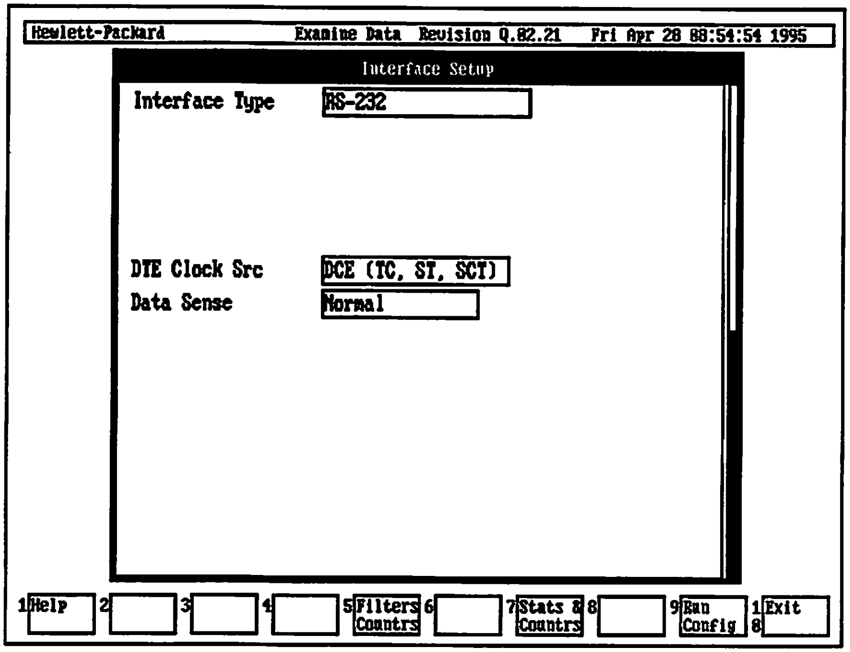


Figure 4-29: Interface Setup at the Time of Stats Logging

4. If you want information on what filter/counters were used when the stats were logged, press **F5** (Filters Countrs). Once again, you cannot make selections in this screen; it is displayed only to show you how the filters and counters were configured when the stats were logged.

5. Press **F7** (Stats & Countrs) to view the log file. An example is shown in Figure 4-30.

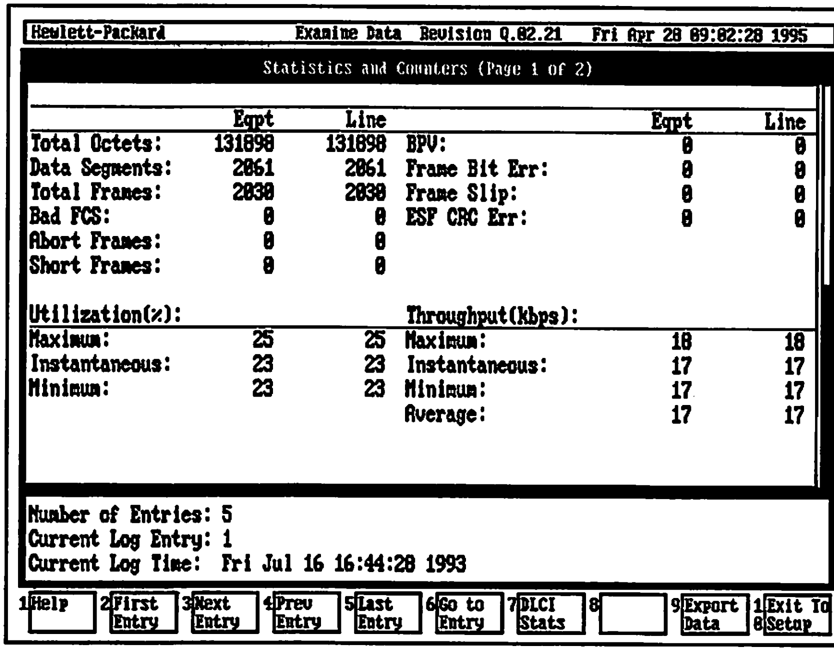


Figure 4-30: Stored Statistics and Counters

Each of the statistics sampling periods is represented by an entry in the log. The softkeys facilitate navigating through the data.

F1 (Help)	Invokes the Internet Advisor Help system.
F2 (First Entry)	Goes to the first entry in the log.
F3 (Next Entry)	Goes to the next entry in the log.
F4 (Prev Entry)	Goes back one log entry.
F5 (Last Entry)	Goes to the last entry in the log.
F6 (Go to Entry)	Goes to a user-specified log entry.
F7 (DCLI Stats)	Views the DCLI-specific statistics in Frame Relay.

F7 (LCN Stats)	Views the LCN-specific statistics in X.25.
F9 (Export Data)	Exports the log data in a comma-separated variable format (`*.csv`) for importing into spread sheets or other software. Refer to the following section, "Exporting Statistics," for more information.
F10 (Exit to Setup)	Returns to the stored Interface Setup Menu.

Exporting Statistics

Once you have used View Stats Log to load a previously-stored statistics log file, you can then export the log data in a comma-separated variable format (`*.csv`) so that it can be imported into spread sheets or other software.

To export a log file, do the following:

1. Load a previously-stored statistics log file as described in the previous section "Viewing Statistics Logs."

2. From the Statistics and Counters screen, press **F9** (Export Data). The Export Data to Comma Separated Format Menu opens. An example is shown in Figure 4-31.

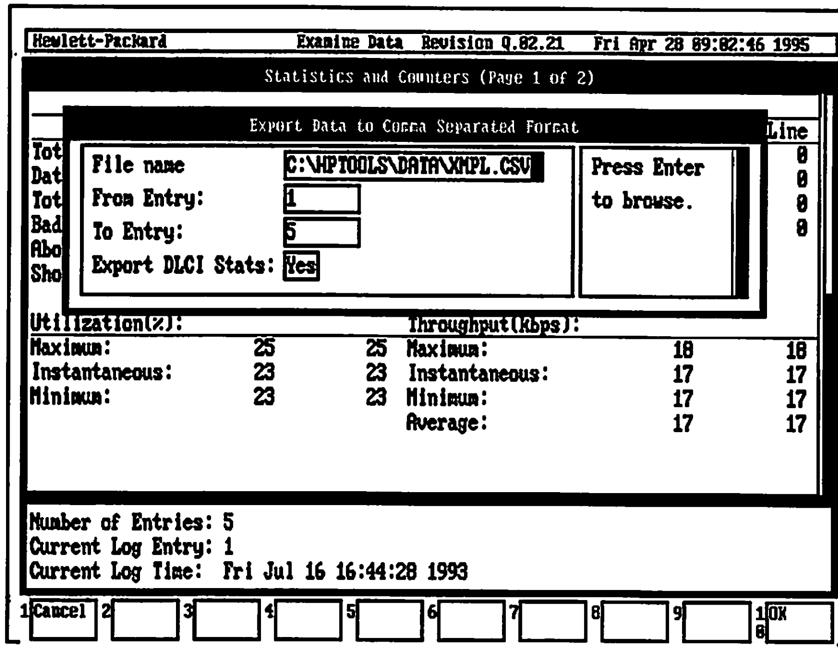


Figure 4-31: Export Data to Comma Separated Format Menu

3. Enter a path and file name with a .CSV extension into the **File Name** field.

4. If you want to specify a range of entries to store, use the **From Entry** and **To Entry** fields.

5. Use the **Export DLCI Stats** field (for Frame Relay) or the **Export LCN Stats** field (for X.25) to control whether these additional statistics are also exported.

6. Press **F10** (OK) to export the stats to the file.

A typical *.CSV set of entries is shown in Figure 4-32. Each paragraph represents a complete record which is delimited with a carriage return. Individual data items are delimited with commas. Any fields which contain punctuation have quotations around the entire field. This technique is a common procedure for exchanging data among multiple applications.

The first paragraph tells which data is represented. The next paragraph names the fields. If there were user-chosen names for the filter/counters, they would be seen here. Paragraphs 3 through 7 represent 5 sample periods complete with time stamps. CSV data can be viewed in most word processors as a text file.

```
"Equipment Link Stats"

"Date","Time","Total Octets:","Data Segments:",
"Total Frames:","Bad FCS:","Abort Frames:",
"Short Frames:","BPV:","Frame Bit Err:",
"Frame Slip:","ESF CRC Err:","Max. Util:",
"Inst. Util:","Min. Util:","Max. Thru:",
"Inst. Thru","Min. Thru","Avg. Thru","Filt/Cnt 1",
"Filt/Cnt 2","Filt/Cnt 3","Filt/Cnt 4","Filt/Cnt 5",
"Filt/Cnt 6","Filt/Cnt 7","Filt/Cnt 8","Filt/Cnt 9",
"Filt/Cnt 10","Filt/Cnt 11","Filt/Cnt 12",
"Filt/Cnt 13","Filt/Cnt 14","Filt/Cnt 15","Filt/Cnt 16"

"16-Jul-93","16:44:28",131898,2061,2030,0,0,0,0,0,0,0,
25,23,23,18,17,17,17,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

"16-Jul-93","16:45:28",132142,2065,2033,0,0,0,0,0,0,0,
25,23,23,18,17,17,17,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

"16-Jul-93","16:46:28",27917,437,451,0,1,1,0,0,0,0,15,
15,0,11,10,0,3,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

"16-Jul-93","16:47:28",80361,1256,1286,0,0,0,0,0,0,0,
15,15,14,11,10,10,10,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0

"16-Jul-93","16:48:28",14744,231,237,1,7,1,0,0,0,0,15,
0,0,10,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
```

Figure 4-32: A Comma-Separated Variable File

5

Simulating

Overview

Simulation is the process by which the Internet Advisor, using its High Speed Analyzer capability, generates traffic, and responds to the resulting network activity. Simulation is run from user-created or HP supplied tests programs. The Internet Advisor performs Simulation for synchronous bit-oriented protocols either through the V-Series or T1/E1 interfaces. The Internet Advisor gives special support for HDLC derivative link protocols (such as; LAB-B and LAP-F) and X.25 and Frame Relay network protocols.

Simulation works in conjunction with the monitoring capabilities of the Internet Advisor to provide stimulus plus full decode and statistics measurements. Refer to chapter 4, "Monitoring," for a full discussion of decode and statistical capabilities of the Internet Advisor.

NOTE

Asynchronous simulation capability exists in the Low Speed Analyzer portion of Internet Advisor. This low speed simulation capability is patterned after the HP 4957A protocol analyzer. Refer to the *HP Low Speed Analyzer User's Guide* for more information.

You can use simulation programs to test and exercise portions of network device operation. These programs usually cannot provide complete emulation of a particular device, but they are sufficient to exercise and test critical characteristics of the network component under test. It is a good idea to test for both normal operation and for exception conditions. The Internet Advisor can transmit normal traffic as well as frames with bad frame check sequence (FCS) values, out of sequence or inappropriate responses, oversized or undersized transmissions, and other stress patterns.

Example programs (also called supplied tests) are included with the Internet Advisor operating system. You can use these programs directly or you can edit them to meet your needs. You can also create and run your own simulation programs to test devices and links in your communications system. Refer to the "Example Simulate Program" section in this chapter for information on writing your own simulate program.

The following are typical applications for Simulation:

Circuit Commissioning	link initialization, placing and receiving X.25 calls and Frame Relay LMI emulation tests.
Traffic Loading	to create controlled amounts of traffic to test network devices.
Equipment Testing	for stimulus/response tests to verify conformance with standards and specifications.
Beaconing	to provide a recognizable signal when examining multiplexor/demultiplexor pairs and switches.
Data Dependent Error Rate Testing	to create test scenarios more complex than BERT to test error characteristics of links and devices to burst data traffic.
Data Generator	for demonstration of other devices.

Running an Example X.25 Simulation

Use the following procedure to run an example X.25 simulation:

1. Highlight **High Speed Analyzr** by using the arrow keys from the Main Group of Toolkit, and press **ENTER** (refer to Figure 5-1).

2. Highlight **X.25 Tests** and press **ENTER** (refer to Figure 5-2).

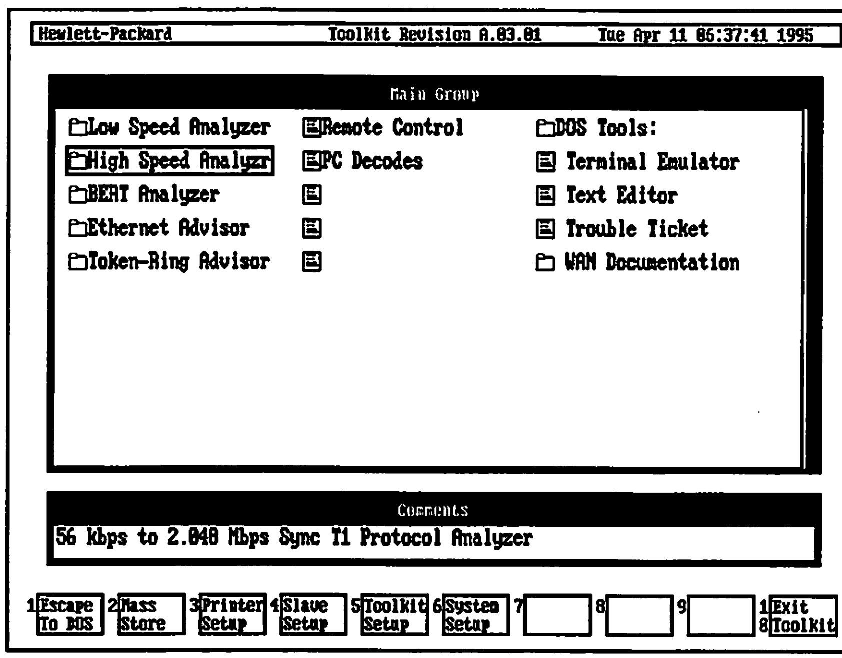


Figure 5-1: Main Group (Power-Up Screen)

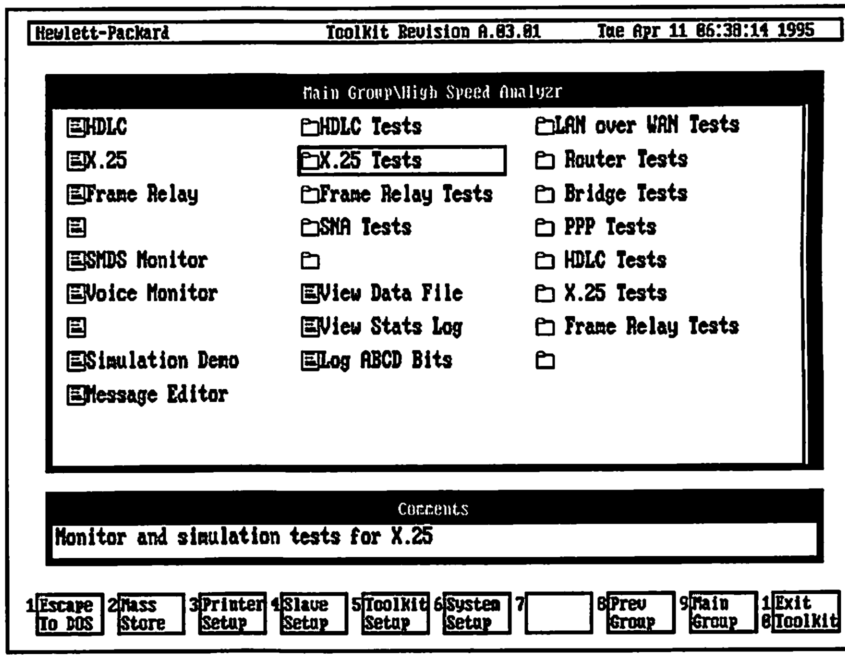


Figure 5-2: Main Group\High Speed Analyzer

3. Highlight **Subscriber Call** and press **ENTER** (refer to Figure 5-3).

This program will be used as our example of a simulate program. Selecting an item with a page icon () sometimes displays the Interface Setup Menu, and then allows you to start the test, and other times it starts the test directly. Press **F10** (Exit To Setup) to access the Interface Setup Menu after starting a test.

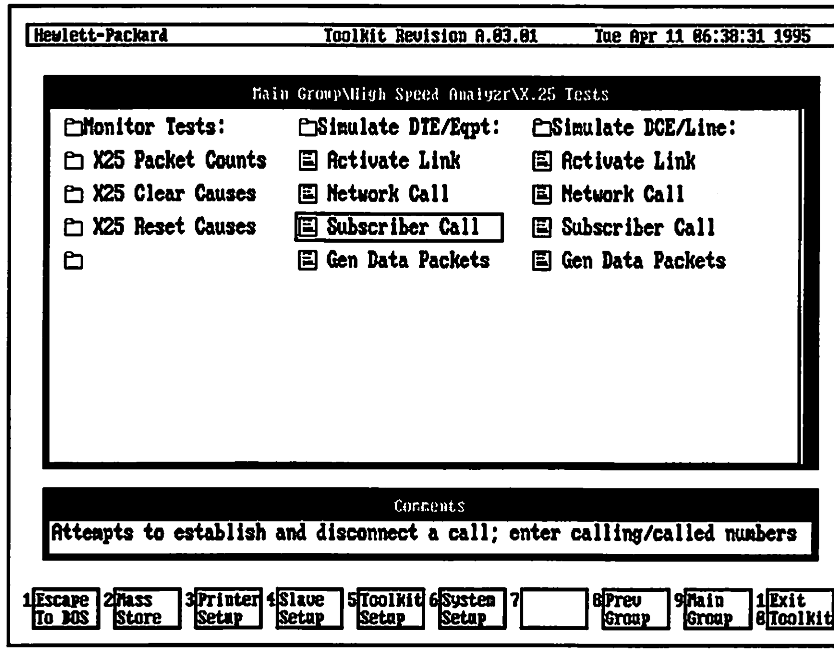


Figure 5-3: X.25 Tests

4. Configure the Interface Setup Menu for the link you wish to test.

Determine your connection scheme and set the **Run Mode** to Simulate (Line / Eqpt or DCE / DTE). Refer to chapter 2, "Connecting to the Network," for more information.

5. Set **Auto Seq Nums** to On, if you wish the Internet Advisor to automatically calculate and send level 2 frame sequence numbers and level 3 packet sequence numbers. Refer to chapter 3, "Configuring the Internet Advisor," for more information on interface configuration.

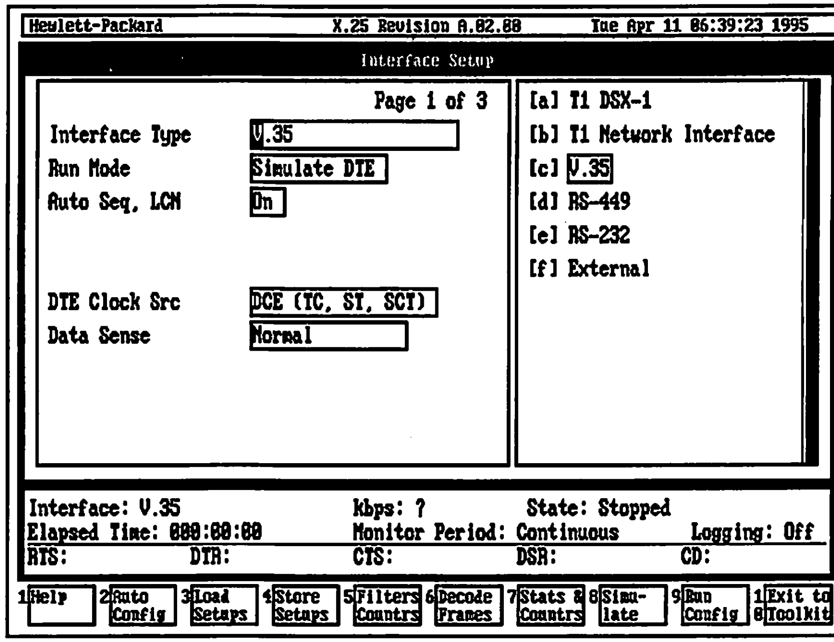


Figure 5-4: Interface Setup Menu

NOTE

Simulation screens show real-time updates of the interface status in the bottom portion of the screen.

6. Press **F8** (Simulate) to configure simulation, after configuring the Interface Setup Menu.

Figure 5-5 shows the beginning of the **Subscriber Call** simulate program.

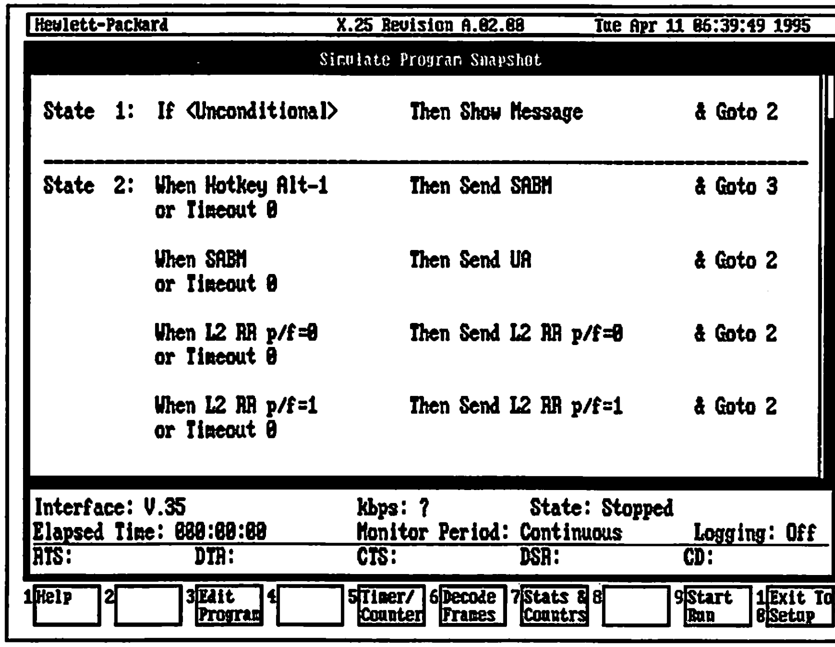


Figure 5-5: Simulate Program Snapshot Screen

Editing A Simulation Program

You can press **F3** (Edit Program), while simulation is stopped, to edit a simulation program. Figure 5-6 shows the Edit Program Menu. The first statement in a State is the **If** or **When** (which are triggers) and the second statement is the **Then** or **& Goto [XX]** (or Actions).

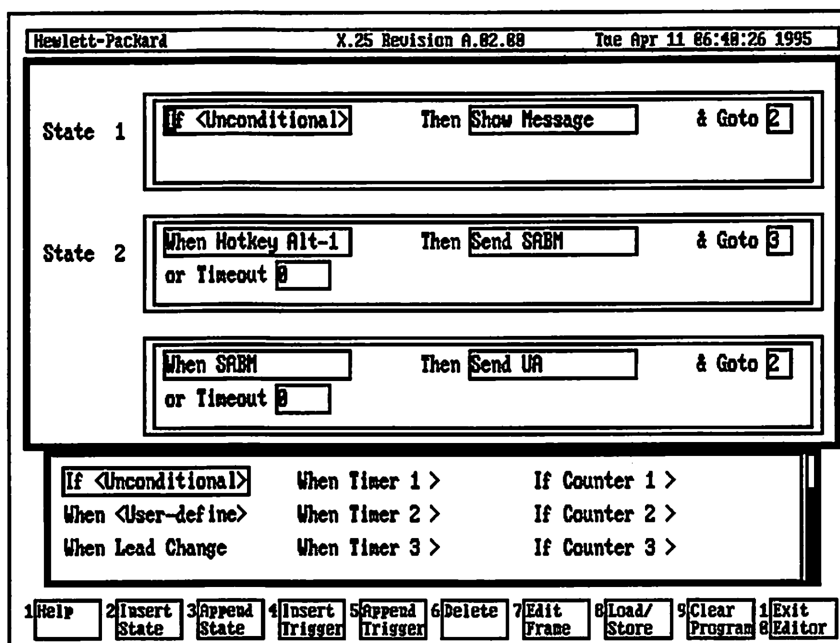


Figure 5-6: Edit Program Menu

The following softkeys are available from the Edit Program Menu:

F1 (Help)	Access the Help System.
F2 (Insert State)	Adds a null state above the state containing the cursor.

F3 (Append State)	Adds a null state below the state containing the cursor.

CAUTION Inserting or Appending States causes renumbering of States and Gotos.

F4 (Insert Trigger)	Adds a null statement above the statement containing the cursor.
F5 (Append Trigger)	Adds a null statement below the statement containing the cursor.
F6 (Delete)	Deletes the statement containing the cursor after prompting you for verification.
F7 (Edit Frame)	Brings up the Modify User-defined Frame screen for editing the When Frame trigger containing the cursor. Refer to **Send <User-def>** in the "Available Actions" section of this chapter for more information.
F8 (Load/Store)	Invokes the mass storage system to load or store a simulate program (in the format of `filename.SIM`).
F9 (Clear Program)	Resets the program to only a State 1, containing the null statement after prompting you for verification to clear the program.
F10 (Exit Editor)	Saves the edited simulate program and returns to the Simulate Program Snapshot screen. You are prompted to confirm the overwriting of the existing file. Select `Yes` to confirm overwriting the file and to exit, `No` to abandon any editing that you have made and to exit, or `Cancel` to return to the Simulate Program Snapshot screen.

If you wish to save your edited program as a new file, press **Cancel.** In the Edit Program Menu, press **F8** (Load/Store) and save the program to another file name. This program also becomes the new default Simulate program. Next Press **F10** (Exit Editor) and

again, you must select `Yes` to confirm overwriting the file and to exit, `No` to abandon any editing that you have made and to exit, or `Cancel` to return to the Simulate Program Snapshot screen.

Restoring Modified Simulate Programs to Their Original State

Most of the tests supplied with the Internet Advisor are write-protected. This forces you to save modifications made to supplied tests in files with new names. However, since the HP-supplied simulate programs may require some modifications to function properly, they are not write-protected. You can use the following procedure to restore all HP-supplied simulate programs to their original state:

CAUTION

If you have modified any supplied simulate programs without saving them to a new file name, and you use the following procedure, you will loose your custom programs. To save your custom programs, copy them to new file names prior to using the following procedure.

1. Press **F10** (Exit Toolkit) from the Main Group screen, and then select `YES` to go to the DOS prompt.
2. Type **`simrest`** and then press **ENTER.** This runs a batch file that restores all the supplied simulate programs to their original condition.
3. Type **`hptools`** and then press **ENTER** to re-start the Toolkit.

Programming Features and Considerations

The Simulation program language of the Internet Advisor is an improved version of the programming language of the Hewlett-Packard 495X family of protocol analyzers. It is an interpreted language engineered for ease of use and high performance. Programming is accomplished by use of menu selections and keyboard entry.

Programming is structured into States. There can be multiple statements per state and the first state of any program is **State 1**. There can be up to 99 states and each state can be a jump target of a decision or event occurrence. Program branching is directed to a state's number (such as "1"). Branching is direct from either the **Goto** or **Gosub** parameter. To maintain fast programs, there are no function calls or subprograms like those which are common to other programming languages. Looping must be specifically programmed using counters, because there are no predefined looping constructs.

There are five general purpose timers available, denoted as **Timer 1** through **Timer 5**. Each timer can be set by the program to Reset, Started, or Stopped. There are also five counters, denoted as **Counter 1** through **Counter 5**, which can be set by the program to Set, Incremented, or Tested.

Programming statements can be in one of the following two forms:

If <Decision True> **Then** <Perform Action> **& Goto** <State ##>

If the decision is false, the program passes to the next statement or, if this is the last statement of a State, the program passes to the next State.

When <Event Occurs> **Then** <Perform Action> **& Goto** <State ##>
or Timeout <# millisec> **Then** <Perform Action> **& Goto** <State ##>

If **Timeout** is set to zero, the trigger will never time out and the second form then appears as the following:

When <Event Occurs> **Then** <Perform Action> **& Goto** <State ##>
or Timeout 0

If there are multiple **When** statements (with corresponding **Timeout** statements) within a State, the lowest non-zero **Timeout** value is used for the entire state. If none of this State's **When** statements are satisfied, then the action and branch statements that follow the lowest non-zero **Timeout** are executed.

You can create a simulate program from scratch by pressing **F8** (Simulate) from the Interface Setup Menu. You can also create a simulate program from scratch by pressing **F3** (Edit Program) from the Simulate Program Snapshot screen. You can also load an existing simulate program from the Edit Program Menu by pressing **F8** (Load/Store), selecting or entering the path and file name, and pressing **F2** (Load Program).

If you want to edit a program that you have just loaded or to create your own program from scratch, you must first save the program under a new name. To do this, press **F8** (Load/Store), rename the file, and then press **F3** (Store Program). Simulation begins by reading the program file from mass storage and starting the test.

CAUTION

If you intend to create a complex program, store it frequently. Very large programs can exceed the available memory causing the Internet Advisor to display the message: `FATAL ERROR: OUT OF MEMORY`. The operating system then returns to Toolkit. To recover, reload the last saved copy of your program and partition it into smaller modules and then save them.

Available Triggers

All triggers are available from the bottom window of the Edit Program Menu (**F3**) when the flashing cursor is in any trigger field. The following are the available triggers for simulation programming. Refer to the "Making a User-Defined Trigger Frame" section in this chapter for information on creating trigger frames.

If <Unconditional>	No test, just perform the subsequent action.
When <User-defined>	Tests for the occurrence of a User-defined frame. You can define multiple frames for test purposes. Once defined, these frame also appear in the list of available triggers as **When (User-Given-Name).**
When Lead Change	Tests for a state change on one of the five V-Series control signals, CD, DSR, CTS, DTR, RTS. The change can be: **Goes Off**, **Goes On**, or **Toggles** (changes state.)
When Hotkey Alt-1 **When Hotkey Alt-2** **When Hotkey Alt-3**	Tests for program branch by manual user-input. These three allow for user-defined control of program execution. Press and hold **ALT** and then press **1**, **2**, or **3**.
When Timer 1 > [#####] **When Timer 2 > [#####]** **When Timer 3 > [#####]** **When Timer 4 > [#####]** **When Timer 5 > [#####]**	Tests timers. The test range is from 0 to 99,999 milliseconds (about 100 seconds.) A test of a timer is True only when its programmed value is exceeded. Timers continue to run until they are stopped or reset.
If Lead State =	Simultaneous test of all five V-Series control leads (CD, DSR, CTS, DTR, RTS.) Each lead can be tested for **On**, **Off**, or **Don't Care**. All five leads must be in the correct configured state for the test to be True.

If Counter 1 > [#####] **If Counter 2 > [#####]** **If Counter 3 > [#####]** **If Counter 4 > [#####]** **If Counter 5 > [#####]**	Tests counter values. The range is 0 to 99,999. When the value of the specified counter is greater than the programmed value, the test is True. These counters are independent of the 16 Filter/Counters available in Monitor Mode.

NOTE

The actual range of counters is 0 to 4,294,967,295 (2^32 - 1). The actual range of the timers is 0 to 4,294,967,295 milliseconds. These values can be observed during operation by pressing **F5** (Timer/Counter). If counts or times exceed these values, the results are no longer reliable. This would be more than 1193 hours (or 7 weeks) for timed measurement.

Available Actions

All actions are available from the bottom window of the Edit Program Menu (**F3**) when the flashing cursor is in any action field. The following are the available actions for simulation programming. Refer to the "Making a User-Defined Message" section in this chapter for information on creating messages.

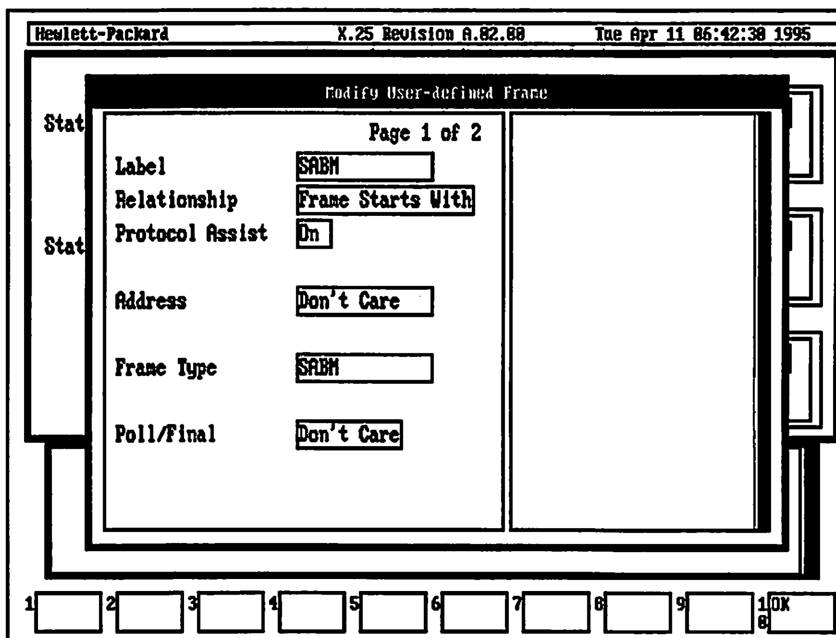


Figure 5-7: Modify User-defined Frame

Send <User-def> Allows you to define frames of up to 62 bytes long for transmission. Use the Modify User-defined Frame screen (Figure 5-7) to define your frame. Data can be entered in hexadecimal or text from the keyboard or can be loaded from a file. Once defined, these frames

appear in the list of available actions as **Send (User-Selected-Name)**. If you need user-created messages longer than 62 bytes, use the **Send File** action. If the **Auto Seq Nums** field is set to On in the Interface Setup Menu, then the N(s) and N(r) parameters are automatically sent (for X.25, P(s) and P(r) are sent.) Also, the "Combined LCN" (LCGN + LCN) of the first Call Request packet, transmitted or received, becomes the default LCN for all subsequent transmissions. In Frame Relay, LMI message sequence numbers are generated and acknowledged.

Send File

Allows you to send a user-defined message file, of up to 996 bytes, as data. The file is sent exactly as written. Protocol parameters must be specifically defined. The file must be in the format `*.DAT` (for Previously captured data) or `*.UDM` (for user-defined message.) All `*.DAT` files are truncated to the last complete frame less than 10,000 bytes. You can create a user-defined message in the Message Editor screen (refer to the "Message Editor" section of this chapter.).

Incr. Cntr. 1 by [####]
Incr. Cntr. 2 by [####]
Incr. Cntr. 3 by [####]
Incr. Cntr. 4 by [####]
Incr. Cntr. 5 by [####]

Use these actions to individually increment each of the five counters in steps of 0 to 9999.

Set Counter 1 [####]
Set Counter 2 [####]
Set Counter 3 [####]
Set Counter 4 [####]
Set Counter 5 [####]

Use these actions to individually set each of the five counters from 0 to 9999. Setting a counter to a value of zero is the same as clearing that counter (for example: **Set Counter 1 [0]** clears **Counter 1**).

Stop Tests

Stops the simulation while leaving the Interface active. No branch target can follow a **Stop Tests** action.

Wait (ms) [####]	Use this action to program a delay from 0 to 9,999 milliseconds.
Start Timer 1 **Start Timer 2** **Start Timer 3** **Start Timer 4** **Start Timer 5**	Use these actions to start the specified timer. This timer remains active until Stopped by you or your program.
Reset Timer 1 **Reset Timer 2** **Reset Timer 3** **Reset Timer 4** **Reset Timer 5**	Use these actions to reset the specified timer to zero. If the specified timer is running when the Reset Timer action is executed, it is first zeroed out and then continues the timing.
Set Leads	Allows control of the V-Series control leads DTR and RTS when simulating DTE/Equipment, and CD, DSR and CTS when simulating DCE/Line. Leads can be set to On or Off.
Show Message	Allows you to place a messages on the screen to guide the user of the Internet Advisor. This messages can be up to three 78-characters lines. If you set **Acknowledge** field to Yes, a note box with an **OK** button is displayed on the screen and the display is frozen. If you set the **Acknowledge** field to No, the message is visible on your run-time display for approximately 3 seconds. Typical uses for **Show Messages** are to define the Hotkeys for user actions or to provide explanation for events.
Stop Timer 1 **Stop Timer 2** **Stop Timer 3** **Stop Timer 4** **Stop Timer 5**	Use these actions to stop the specified timer and to save its current value. The timer can be restarted from this saved value by restarting it with out giving it a new value. Timers can be started and stopped any number of times.

Gosub State [XX]	Branches to the beginning State of a subroutine.
Gosub Return	Returns the program flow to the **& Goto [XX]** statement following the **Gosub State [XX]** statement which invoked the subroutine. This must be the final action in a subroutine because you cannot follow this action with a **& Goto [XX]** statement.
Do Nothing	No action is performed.

Message Editor

You can create a user-defined message in the Message Editor screen and then save it for use in any Internet Advisor application. Figure 5-8 shows a sample user-defined message. To use the Message Editor, highlight **Message Editor** in the Main Group\HighSpeed Analyzr screen and press **ENTER**.

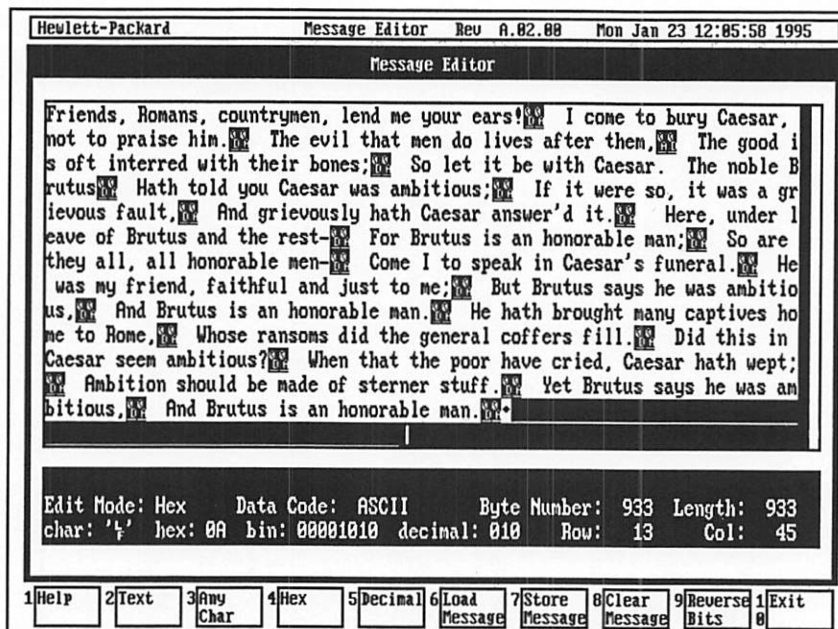


Figure 5-8: Message Editor

You can create user-defined message files of up to 996 bytes long.

The following softkeys are available from the Message Editor screen:

F1 (Help)	Invokes the Help System.
F2 (Text)	Allows you to enter any ASCII coded characters.
F3 (Any Char)	Not applicable in Simulation.
F4 (Hex)	Allows you to enter octets with hexadecimal codes.
F5 (Decimal)	Allows you to enter octets with decimal codes.
F6 (Load Message)	Retrieves a previously stored message.
F7 (Store Message)	Saves current message.
F8 (Clear Message)	Clears current message.
F9 (Reverse Bits)	Changes the transmitted bit order of each octet.
F10 (Exit)	Returns to the Main Group\High Speed Analyzr Menu.

Use the following information for editing messages in the Message Editor screen:

Diamond Character	Shows the end of data that you have entered.
| (Bar)	Shows the end of allowed entries.
SHIFT END	Places the cursor at the end of your message.
END	Places the cursor at the end of the current line.
INS	Toggles the cursor between the insert (block shape) and overstrike (underline shape) modes.

NOTE

To enter characters into a full screen, you must switch the cursor to the overstrike mode. You cannot enter characters into a full screen with the cursor in the insert mode.

<u>The Message Editor does not automatically save your message when you exit the screen</u>. You must save your message to a file using the **F7** (Store Message). The Internet Advisor displays a window where you can enter a path and file name, or you can press **ENTER** to browse in the file system. Files saved from the Message Editor have a `.UDM` file extension. A warning box is displayed if you do not use the `.UDM` extension.

You can use the **F6** (Load Message) to load a previously saved Message Editor file. A window is displayed allowing you to enter a path and file name, or press **ENTER** to browse in the file system.

Use **F8** (Clear Screen) to start over in the Message Editor by deleting your message.

Example Simulate Program

This section describes how to write an example simulate program. As you write this program you will need to define (or write) a User-Defined Message, a User-Defined Frame, and a Show Message. You can get instructions on how to do each of these by referring to the appropriate topic and following the procedure. The following topics are described in this section:

- Writing a Simulate Program
- Making a User-Defined Message
- Making a User-Defined Trigger Frame
- Making a Show Message

Writing a Simulate Program

The very simplest simulate programs (or scripts) are message generators that repeatedly send a user-defined message. The following single statement performs this function:

State 1: If <Unconditional> Then Send TwasBrillig & Goto 1

`TwasBrillig` is the name you would give for one of your user-defined messages. The message can be designed to have protocol assistance for HDLC, X.25, or Frame Relay and could also have a built-in repeat delay of 0 to 99,999 milliseconds.

You could expand this example to send the `TwasBrillig` message 100 times, count the number of responses, and send the message again in one second if you get a response or send the message again in five seconds if you do not get a response. Additionally, you could post a message at the end of your program (or test). Your program needs to have a loop counter, a send message, a response trigger, and a response counter.

Use the following procedure to write your simulate program:

1. Power-on the Internet Advisor, select **High Speed Analyzr** and then select **HDLC**, **X.25**, or **Frame Relay**.

   Your choice of **HDLC**, **X.25**, or **Frame Relay** depends on which type of simulate program that you are writing.

2. Configure the Interface Setup Menu for your conditions and be sure to set the **Run Mode** to Simulate.

   If you are using HDLC derivative protocols, set **Auto Seq Nums** to On.

3. Press **F8** (Simulate) and then press **F3** (Edit Program).

4. Press the Right Arrow key once to move the flashing cursor to the **Then** field and press **ENTER**.

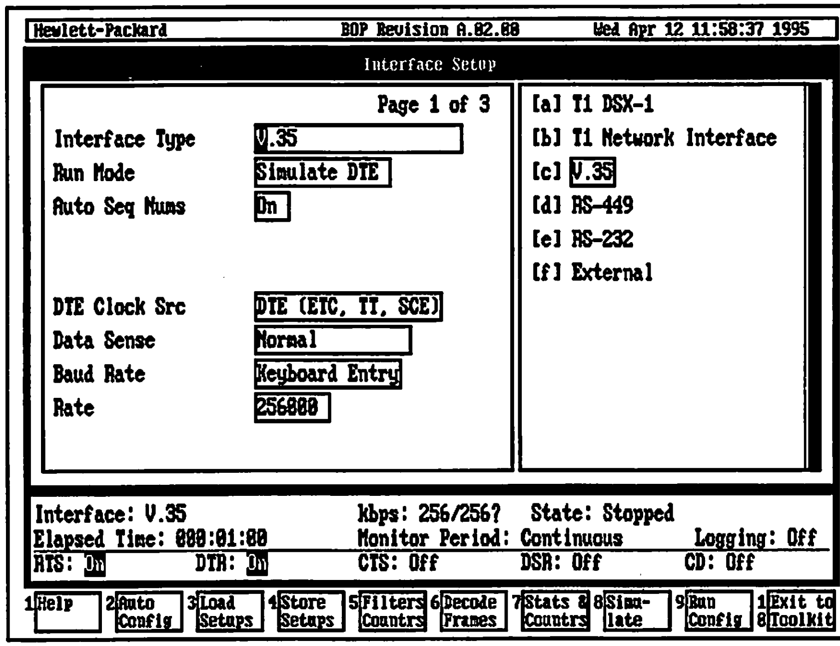


Figure 5-9: Interface Setup Menu

5. Use the arrow keys to highlight **Set Counter 1** in the bottom window and then press **ENTER**.

6. Press the Right Arrow key to move to the flashing cursor to the Counter Value field and enter **0** (it may already be set to zero).

7. Press the Right Arrow key to move to the flashing cursor to the **& Goto** field and enter **2** (for State 2).

You should now have the following for State 1. Comments regarding each state are shown in *italics*.

State 1: **If <Unconditional>** **Then Set Counter 1 0** **& Goto 2**
This is your loop counter with Counter 1 set to zero.

8. Press **F3** (Append State) to get another state added to your program.

9. Repeat this process to construct all of the following states and triggers.

State 2: If <Unconditional> Then Set Counter 2 0 & Goto 3
This is your response counter with Counter 2 set to zero.

10. Press **F3** (Append State).

State 3: If <Unconditional> Then Incr. Cntr. 1 by 1 & Goto 4
This increments the loop counter.

11. Press **F3** (Append State).

State 4: If Counter 1 > 100 Then Do Nothing & Goto 7
This exits the loop and ends the program when Counter 1 reaches 101.

12. Press **F5** (Append Trigger) to get a trigger added to your current state (there can be multiple triggers per state).

If <Unconditional> Then Send TwasBrillig & Goto 5
Send the user-defined message. Refer to the "Making a User-Defined Message" topic in this section for information on constructing a message.

13. Press **F3** (Append State).

State 5: When SlitheyToves Then Incr. Cntr. 2 by 1 & Goto 6
or Timeout 5000 Then Do Nothing & Goto 3
Your test for receiving a user-defined frame. When it is received, Counter 2 is incremented by 1 and the program continues at State 6. If it has not been received within 5 seconds (5000 milliseconds) the program continues at State 3 where it increments the loop counter and sends the test message again. Refer to the "Making a User-Defined Trigger Frame" topic in this section for information on constructing a trigger frame.

14. Press **F3** (Append State).

State 6: If <Unconditional> Then Wait (ms) 1000 & Goto 3
This state waits 1 second before retransmitting the test message.

15. Press **F3** (Append State).

State 7: If <Unconditional> Then Show Message & Goto 8
This state puts a message on the screen to let the user know that the test is complete. Refer to the "Making a Show Message" topic in this section for information on constructing a Show Message.

16. Press **F3** (Append State).

State 8: If <Unconditional> Then Stop Tests
This state completes the test.

17. Press **F8** (Load/Store), enter the directory and file name you want to give to your simulation program, and press **F3** (Store Program).

You should give your program a unique file name so that it does not mistakenly get lost by someone saving a file to the same name. To do this you can modify the default path and file name (or you could press **ENTER** to access the file system and browse through the existing directories.) If the path and file name exist, the Internet Advisor prompts you for verification to overwrite the current file.

18. Press **F10** (Exit Editor). The Internet Advisor prompts you for verification to overwrite the current file (in this case the current file is your simulate program that you just saved.) Select `Yes` to save it again and continue.

The Internet Advisor automatically configures itself with the new simulate program and displays the Simulate Program Snapshot screen. Press **F9** (Start Run) and the Internet Advisor starts simulating with your simulate program. The program runs to completion or until you press **F9** (Stop Sim). If you exit simulation, you are asked if you want to turn the transmitters Off. You can turn the transmitters off, but some links (particularly T1 and E1 circuits when doing drop and insert testing, and dialed modem connections from the V-Series interfaces) should remain On.)

Making a User-Defined Message

You can develop a user-defined message for use in your programs. If you want, the Internet Advisor can provide protocol assistance by setting the **Protocol Assist** field to On. Once created, this trigger becomes part of the Internet Advisor's library of messages. All messages are available from the bottom window of the Edit Program Menu (**F3**) when the flashing cursor is in any action field.

Use the following procedure to create a user-defined message:

1. Place the flashing cursor in the desired **Then** field, press **ENTER**, and select the **Send <User-def>** action.

2. Configure your message (also called a frame) from the **Modify User-defined Frame** screen as shown in Figure 5-10.

NOTE

After you create a message, it can be edited by placing the message name in the **Then** field, pressing **ENTER**, and then pressing **F7** (Edit Frame).

3. Press **F10** (OK).

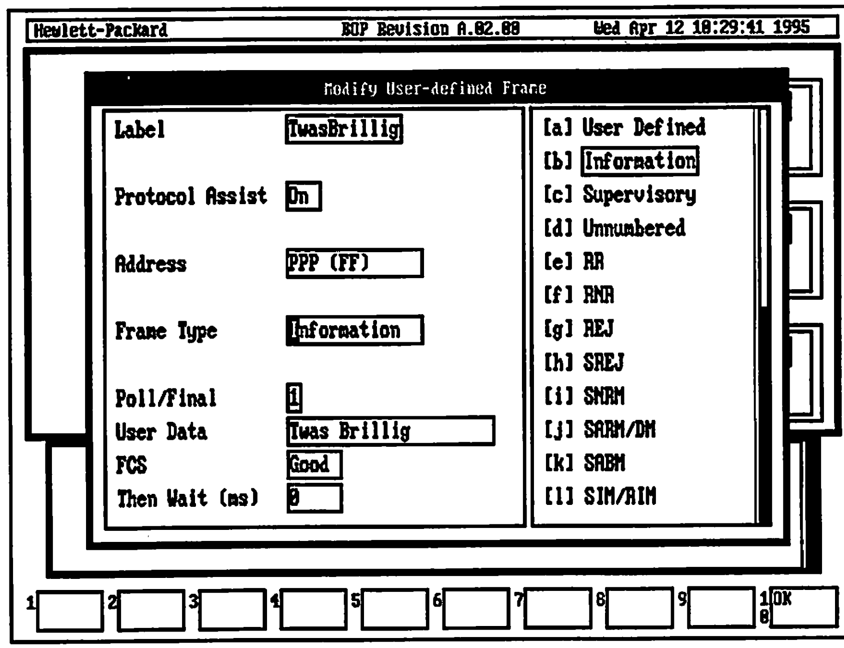


Figure 5-10: Modify User-defined Frame (Send Frame)

Use the following information to configure the fields in the Modify User-defined Frame screen:

Label Enter an action name for your message frame (up to 11 characters.)

Protocol Assist On
Off

Address, Frame Type, and Poll/Final are only available if Protocol Assist is On. When Off, the following **User Data** field changes to **Data String**, but it functions the same.

Address User Defined
DCE (01)
DTE (03)
PPP (FF)

Frame Type	User Defined	UA
	Information	UI
	Supervisory	UP
	Unnumbered	RSET
	RR	XID
	RNR	SABME
	REJ	TEST
	SREJ	FRMR
	SNRM	SNRME
	SARM/DM	SARME
	SABM	BCN
	SIM/RIM	CFGR
	DISC/RD	
Poll/Final	0	
	1	
User Data	Enter a message or the name of a user-defined message file. If you are entering a message, first enter **CTRL** H for Hex, **CTRL** T for Text, or **CTRL** D for Don't Care and then enter your message. To load a file, first press **ENTER** and then enter the path and file name or press **ENTER** again to browse through the file system.	

HINT

Normally the user-defined messages are limited to less than 64 bytes depending upon the protocol selected. Longer frames can be constructed using data files (*.DAT) or user-defined messages (*.UDM) written in the Message Editor screen (refer to the "Message Editor" section of this chapter.) If you wish to have the Internet Advisor provide byte values for the protocol headers in these user-defined message, first create a short message using Simulate with the **Protocol Assist** field set to On and then run the simulation program and transcribe the needed byte values to use in the Message Editor screen.

FCS	Good
	Bad
	Abort
Then Wait (ms)	Enter a time period to wait (in milliseconds) between sending a message and proceeding with next program action.

Making a User-Defined Trigger Frame

You can develop a user-defined trigger frame for use in your programs. If you want, the Internet Advisor can provide protocol assistance by setting the **Protocol Assist** field to On. Once created, this trigger become part of the Internet Advisor's library of triggers. All triggers are available from the bottom window of the Edit Program Menu (**F3**) when the flashing cursor is in any trigger field.

Use the following procedure to create a user-defined trigger frame:

1. Place the flashing cursor in the desired trigger field, press **ENTER**, and select the **When <User-defined>** trigger.

2. Configure your trigger frame from the **Modify User-defined Frame** screen as shown in Figure 5-11.

NOTE

After you create a trigger frame, it can be edited by placing the trigger name in a trigger field, pressing **ENTER**, and then pressing **F7** (Edit Frame).

3. Press **F10** (OK).

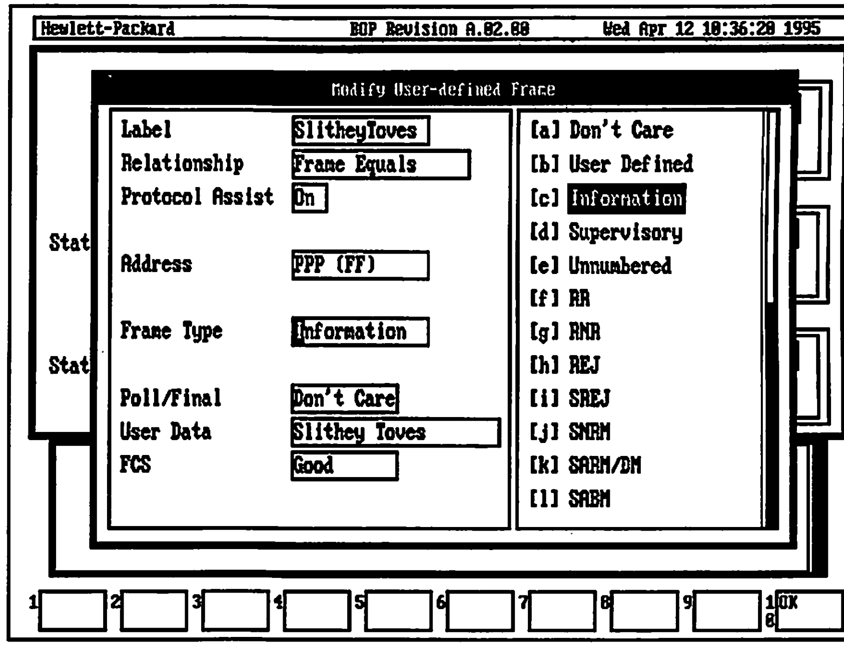


Figure 5-11: Modify User-defined Frame (Trigger Frame)

Use the following information to configure the fields in the Modify User-defined Frame screen:

Label Enter an action name for your message frame (up to 13 characters.)

Relationship Frame Starts With
Frame Equals
Frame Ends With

Protocol Assist On
Off

Address, Frame Type, and Poll/Final are only available if Protocol Assist is On. When Off, the following **User Data** field changes to **Data String**, but it functions the same.

Address	Don't Care	
	User Defined	
	DCE (01)	
	DTE (03)	
	PPP (FF)	
Frame Type	Don't Care	DISC/RD
	User Defined	UA
	Information	UI
	Supervisory	UP
	Unnumbered	RSET
	RR	XID
	RNR	SABME
	REJ	TEST
	SREJ	FRMR
	SNRM	SNRME
	SARM/DM	SARME
	SABM	BCN
	SIM/RIM	CFGR
Poll/Final	0	
	1	
	Don't Care	
User Data	Enter a message or the name of a user-defined message file. If you are entering a message, first enter **CTRL** H for Hex, **CTRL** T for Text, or **CTRL** D for Don't Care and then enter	

your message. To load a file, first press **ENTER** and then enter the path and file name or press **ENTER** again to browse through the file system.

FCS Good
Bad
Abort
Don't Care

Then Wait (ms) Enter a time period to wait (in milliseconds) between sending a message and proceeding with next program action.

In a similar manner, simulation in X.25 and Frame Relay provides protocol help in the creation of frames. X.25 simulation includes layer 3 packet parameter help.

Making a Show Message

You can develop a Show Message action for use in your programs. A Show Message is an action that, when executed in a simulate program, displays a message to prompt a user for action. Once created, this message is available from the bottom window of the Edit Program Menu (**F3**) when the flashing cursor is in any action field.

A Show Message can be define to have up to three 78-character lines of text. Each line is centered and the on-screen message box is sized to fit the longest line. Use the following procedure to create a Show Message action:

1. Place the flashing cursor in the desired **Then** field, press **ENTER**, and select the **Show Message** action.

2. Enter up to three 78-character lines of text in the Modify Message Menu as shown in Figure 5-12.

3. Configure the **Acknowledge** field to Yes or No.

Configuring the **Acknowledge** field to Yes causes the message to remain on the screen until the user presses **ENTER** or until the message is overwritten by a subsequent message. Configuring the **Acknowledge** field to No posts the message on the display for three seconds and then returns to normal decode or statistics presentation.

4. Press **F10** (OK).

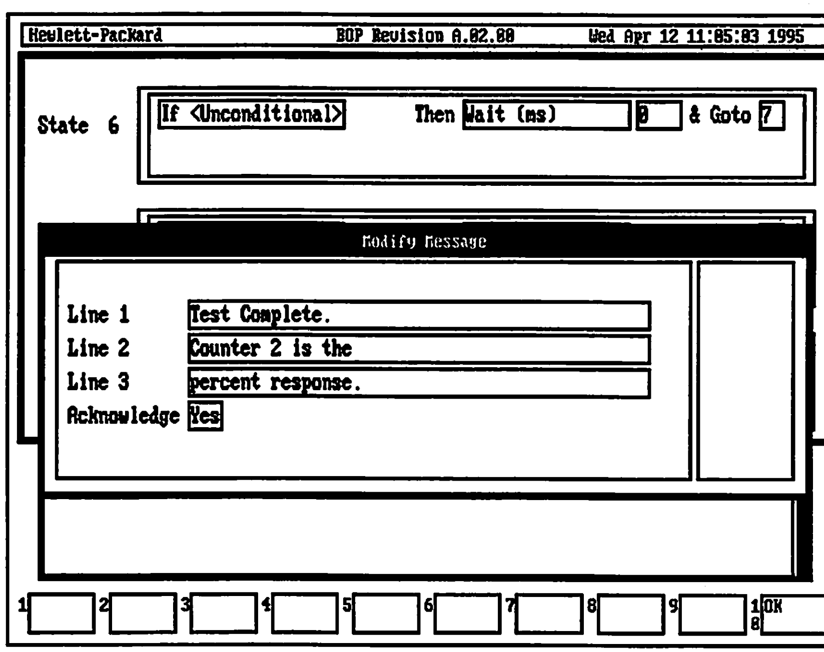


Figure 5-12: Modify Message

X.25 Subscriber Call and Network Call Tests

The X.25 Subscriber Call and Network Call tests allow a call to be placed, data sent and the call cleared, or calls accepted and data received. Table 5-1 shows the four simulation tests within the X.25 Tests file-folder icon.

Table 5-1: X.25 Simulation Preconfigured Tests

Test	Usage
Activate Link	Used to bring up the link layer
Network Call	Allows a call to be established from the network side
Subscriber Call	Allows a call to be established from the user side
Gen Data Packets	Used to generate information frames to load the link from either side

NOTE

If the Internet Advisor has been configured for X.25 simulation and has received an incoming Call Request prior to attempting to place a call, it uses the Combined LCN associated with the incoming request. The Internet Advisor simulation does not support multiple simultaneous logical channels.

You must modify the Calling and Called numbers in order to place a call with the Subscriber Call or Network Call canned tests. You may also have to change the LCN if you cannot use the default value (1).

The Call programs use the LCN that is defined in the Call Request packet and uses that value in all the subsequent packets until a Clear Confirm is received. The LCN that is defined in the program packets are used before the Call Request and after the Clear Confirm.

NOTE If a Call Request Packet is received by the Internet Advisor before the Call Request packet is sent by the Internet Advisor, the received LCN is used until a Clear Confirm is received.

Use the following procedure to modify the Calling and Called numbers in the X.25 **Subscriber Call** or **Network Call** preconfigured tests:

1. Select **High Speed Analyzr** from the Main Group screen of Toolkit.

2. Select **X.25 Tests** file-folder icon from the Main Group\High Speed Analyzr screen.

   Before starting simulation, attach the Internet Advisor to the device or port you wish to test. For a V-Series interface, observe the DTE/SD and the DCE/RD indicator LEDs. If either or both Mark and Space of DTE/SD are illuminated, the device is physically DTE. The Internet Advisor should be configured DCE. Alternately, if either or both Mark and Space of DCE/RD are illuminated, the device is physically DCE. The Internet Advisor should be configured DTE.

   If the Internet Advisor is located physically inside a network and connected to incoming lines, it should emulate Network. If it is substituting for an incoming signal, it should emulate Subscriber.

   If the Internet Advisor is located physically at a user's site and is connected to incoming lines, it should emulate Subscriber. If it is connected to user equipment, it should emulate Network.

3. Select the test of interest from the Main Group\High Speed Analyzr\X.25 Tests screen (for example, **Simulate DTE/Eqpt: Subscriber Call.**)

4. Verify that the configuration is correct in the Interface Setup Menu.

5. Press **F8** (Simulate) and then **F3** (Edit Program).

6. Press **F8** (Load/Store) and create a new file for saving your test changes. This step is optional.

7. Press the Down Arrow key repeatedly until you get to the first statement of **State 4**.

8. Press **F7** (Edit Frame), press **PgDn** to go to **Page 2 of 2**, move the cursor down to **Calling #**, press **CTRL-T** (to set text mode), and enter your **Calling #** as a string of digits.

9. Move the cursor down to **Called #**, press **CTRL-T** (to set text mode), and enter your **Called #** as a string of digits.

10. Change **Logical Channel** if necessary. (This field uses the Combined Logical Channel Number. The range is 1 to 4095.)

11. Press **F10** (OK).

12. Press **F10** (Exit Editor) and then press **ENTER** to answer `Yes` for saving your program. (Your edited simulate program is now the default simulation.)

13. Press **F9** (Start Run) and then press **ENTER** to answer the first message box.

After your simulation begins, press **ALT-1** to send SABM and establish the link, press **ALT-2** to be ready to initiate or accept an X.25 Call, and press **ALT-3** to close the link. The following are the hot-key choices after you press **ALT-2** the first time:

ALT-1	Call Packet/Incoming Call
ALT-2	Data Packet
ALT-3	Clear Request/Indication

6

BERT Analyzer

Overview of Bit Error Rate Testing (BERT)

Bit Error Rate Testing (BERT) is a special case of simulation in which the Internet Advisor is used to send and receive pseudo-random stress patterns to obtain quantitative data about the error characteristics of a communication link or device.

With the Internet Advisor you can make quantitative and qualitative link error measurements in two ways:

- Using the protocol analyzer capabilities of the Internet Advisor, you can gather statistics of errors and throughput on links "in-service."
- Using the BERT capabilities of the Internet Advisor, you can perform the tests recommended by link suppliers and tariffing authorities. Many of the parameters available in BERT measurements form the basis of communications tariffs.

In its high-speed BERT mode, the Internet Advisor gives you a variety of synchronous BERT measurements using the internal V.35, V.36/RS-449 and V.24/RS-232 interfaces, the external X.21 and ISDN interface modules, and the T1 or E1 interface. You can operate at bit rates from 50 bits per second (bps) to 2048 Kbps (also written as 2.048 Mbps).

NOTE

This chapter assumes that you know some basic concepts about T1 and E1 digital network interlinking. If you need to review these concepts, refer to Appendix D, "T1 and E1 Technology Overview."

In its low-speed BERT mode, the Internet Advisor uses its built-in Low Speed Protocol Analyzer capability plus the internal V.35, V.36/RS-449 and V.24/RS-232 interfaces, and the external X.21 and ISDN interface modules so that you can perform synchronous, isochronous and asynchronous BERT from 50 bps to 64 Kbps.

Basically, BERT equipment consists of a generator and a receiver. The generator simulates random user data and the receiver performs a group of measurements on the errors that occur when the test signal passes through the circuit being tested.

You can perform this testing "end-to-end" (the generator is at one location and the receiver at the other) or you can perform the test "looped" (the generator and receiver are both at your location within a single Internet Advisor) with the data being received and returned to you from the other end of the link. In either case, the circuit under test is out of service for the duration of the test.

When you test T1/E1 circuits, you can perform BERT on any or all channels (also called time slots) concurrently. One method of testing is to transmit, or drive, a single channel, leaving the remaining channels in service. The measurements on this one channel are then assumed to be statistically valid for all channels.

BERT testing is done with a set of test patterns of known bit sequences which either simulate random user data or provide patterns known to cause particular stresses in the devices used in the circuit. Patterns simulating random user data are said to be Pseudo-Random Binary Sequences (PRBS) because they obey most of the laws of statistical randomness, but are well-known and repeatable. In practice, PRBS patterns are fixed-length and are usually one less than some integer power of two in length. Common PRBS values available in the High Speed Internet Advisor are shown in Table 6-1.

Table 6-1: Available PRBS Patterns

PRBS	Description
63	(2^6-1) Traditional low-speed 6-bit data simulation. (EBCD, IPARS, etc.)
511	(2^9-1) Simulates 8-bit data. Nine consecutive 0's max.
2047	(2^11-1) Eleven consecutive 0's max.
4095	(2^12-1) Twelve consecutive 0's max.
2^15-1	Fourteen consecutive 0's max. Mainly an E1 test.
2^20-1	Twenty consecutive 0's max. Mainly an E1 test.
2^23-1	Twenty-three consecutive 0's max. Mainly an E3 test.
QRSS	(2^20-1) Limited to 14 consecutive 0's. The most typical T1 test.

Stress Patterns are based upon industry experience with various network hardware. Some common stress patterns are listed Table 6-2. In addition, the Internet Advisor allows you to define your own test patterns.

Table 6-2: Available Stress Patterns

Stress Patterns	Description
3 in 24	Fifteen consecutive zeros, only three 1's in 24. For testing clock recovery.
1 in 8 (1:7)	Mask testing. B8ZS not required.
USER	User-defined, byte-oriented.
All 1's	Maximum heating in T1/E1 repeaters. Use when level testing.
All 0's	Forces B8ZS operation in T1 devices. Forces HDB3 in E1 devices. Tests clock recovery capability.
1010...(1:1)	Alternating 1's and 0's.

BERT measurements are made by first synchronizing the receiver to the incoming bit pattern and then observing these bits to see if they match the selected test pattern. Several measurements are possible. The most basic measurements are the Bit Errors and the Bit Error Ratio (BER.) These are simply the number of bits in error and the number of bits in error divided by the total number of bits received during the test interval, respectively. If all errors are truly random then this is a sufficient test for you to characterize a link.

Errors are not usually random, however. Some communications impairments cause Burst Errors (several bit errors in succession.) To give you a qualitative sense to the nature of errors in the communications circuit, you can perform the Block Errors measurement. Common practice for systems subscribing to AT&T practices is to define a block to be 1000 bits. The 1000 bit block came from the fact that it was approximately the number of bits in the transmission of a single 80 column punched card. Systems subscribing to CEPT/CCITT specifications usually define a block to be equal to the pattern length of the test pattern. If a single bit error occurs within this arbitrary block, it counts as a single block error. If all the bits in the block are in error, it still counts as a single block error.

For a block size of 1000 bits and a BER less than 1 in 100,000 (displayed as 1.0E-005 by the Internet Advisor), if the bit errors are about the same as the block errors, then you can conclude that the errors are random. If the bit errors are significantly greater than the block errors, then errors are clustering and you have an identifiable (and hopefully repairable) impairment present.

Blocking is also done by time. Initially, the time-blocked tests were Errored Seconds, Error Free Seconds, and Percentage Error Free Seconds. Errored Seconds have at least one bit error, Error Free Seconds have no bit errors, and Percentage Error Free Seconds is Error Free Seconds divided by the duration of the test and multiplied by 100.

CEPT recommendation G.821 includes Available Time, Error-Free Second, Errored Seconds, Degraded Minutes, Severely Errored Seconds, and Unavailable Time. Available Time is the elapsed time minus the Unavailable Time. An Error-Free Second is one without errors. An Errored Second is any one second period in which there are one or more errors up to a rate of 1.0E-003 (notice that this is different from Errored Second definition above). A Degraded Minute is one in which the mean BER has been in excess of 1.0E-006. A Severely Errored Second is one in which BER becomes greater than 1.0E-003. Unavailable Time is the length of time that the BERT signal has been undetectable by the test receiver for 10 or more seconds. The Percentage Error-Free Seconds is the number of Error-Free Seconds divided by the elapsed time and multiplied by 100. Any of these measurements can be the metrics of the tariffs by communication link suppliers. The Internet Advisor can help you determine if the link is meeting specifications.

The Internet Advisor gives you additional tests which make unique T1 and E1 measurements. These include T1 Bipolar Violations, ESF CRC Errors, Framing bit errors and Frame Slips; E1 Code Violations, FAS Errors and CRC-4 Errors. Refer to Appendix D, “T1 and E1 Technology Overview,” for definitions of these parameters.

BERT is generally performed for long periods of time. Five-minute tests are usually the minimum length of time. Often, especially for circuits of very low BER, the tests can be performed for 24 hours, or more, in order to obtain meaningful statistics.

G.821 suggests that for typical T1/E1 circuits, BER greater than 1.0E-003 makes the circuit Unacceptable, between 1.0E-006 to 1.0E-003 it is Degraded, from 1.0E-010 to 1.0E-006 it is Acceptable, and BER less than 1.0E-010 makes it Excellent. At 2.048 Mbps, a BER of 1.0E-010 gives less than 1 bit error per hour. One bit error per minute on a T1 link gives a BER of about 1.1E-008.

An acceptable value of BER depends on several factors. Generally, lowering BER increases the cost of networking. For example, changing from copper to fiber can dramatically reduce BER, but is also significantly more expensive.

The Internet Advisor is a tool which can help you decide what BER is satisfactory for your applications. Robust networking protocols such as X.25 can tolerate relatively high BER, even as high as 1.0E-005, with little apparent degradation in user data throughput. The more streamlined networking technologies, such as Frame Relay, demand much lower BER to give satisfactory performance. You can correlate the link level statistics available from the Low Speed Analyzer, or the High Speed Analyzer, with the circuit's BER (as measured with the BERT Analyzer) to help evaluate if attaining a lower BER is worth the cost.

Traditional BERT testing has been performed end-to-end. Many BERT instruments are configured with V series interfaces. These devices usually serve as DTE's (Data Terminal Equipment.) They connect directly to V-series inputs on DCE's (Data Circuit-terminating Equipment), such as Modems, DSU's, and channel banks. When configured for V-series interface, the Internet Advisor connects in this same manner.

In T1 and E1 circuits, there are a great variety of possible points of attachment. A common one is at a CSU (Channel Service Unit.) In addition, there are usually other test points designed into T1 and E1 links. Refer to chapter 2, "Connecting to the Network," for a discussion of test points and attachment considerations.

Overview of Internet Advisor's BERT Tests

The HP J2301A T1 Internet Advisor comes with the T1 system software loaded and the T1 interface module installed. With the T1 Internet Advisor, you can run T1, V-Series (V.24/RS-232, V.35, and V.36/RS-449), ISDN, and X.21 BERT tests. Similarly, the HP J2302A E1 Internet Advisor comes with the E1 system software loaded and the E1 interface module installed. With the E1 Internet Advisor, you can run E1, V-Series, ISDN, and X.21 BERT tests.

To access the BERT tests, from the Main Group screen of Toolkit (the Internet Advisor's power-on screen), use the arrow keys to highlight **BERT Analyzer,** and then press **ENTER**. This opens the Main Group\BERT Analyzer screen. Figure 6-1 shows the Main Group screen and Figure 6-2 shows the Main Group\BERT Analyzer screen for the T1 Internet Advisor.

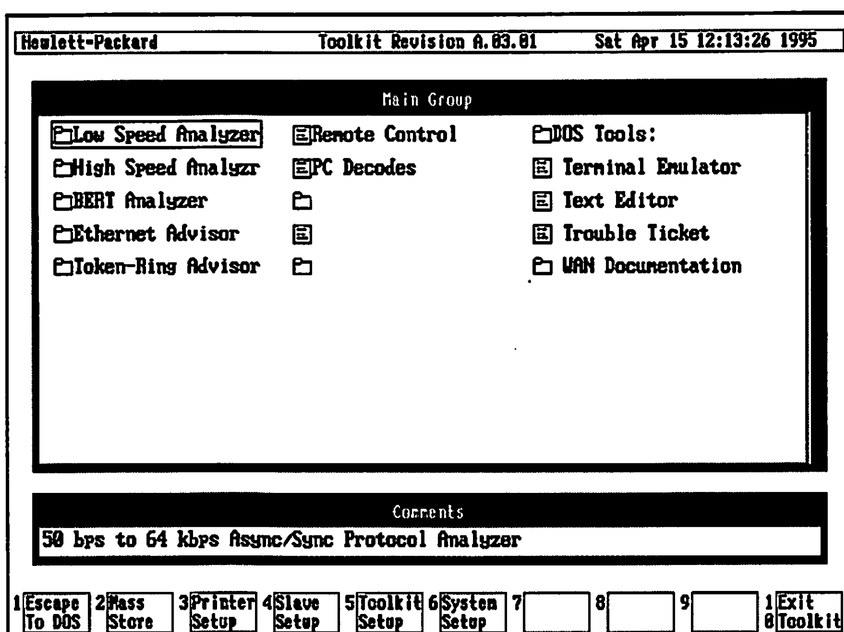


Figure 6-1: T1 Internet Advisor Main Group Screen

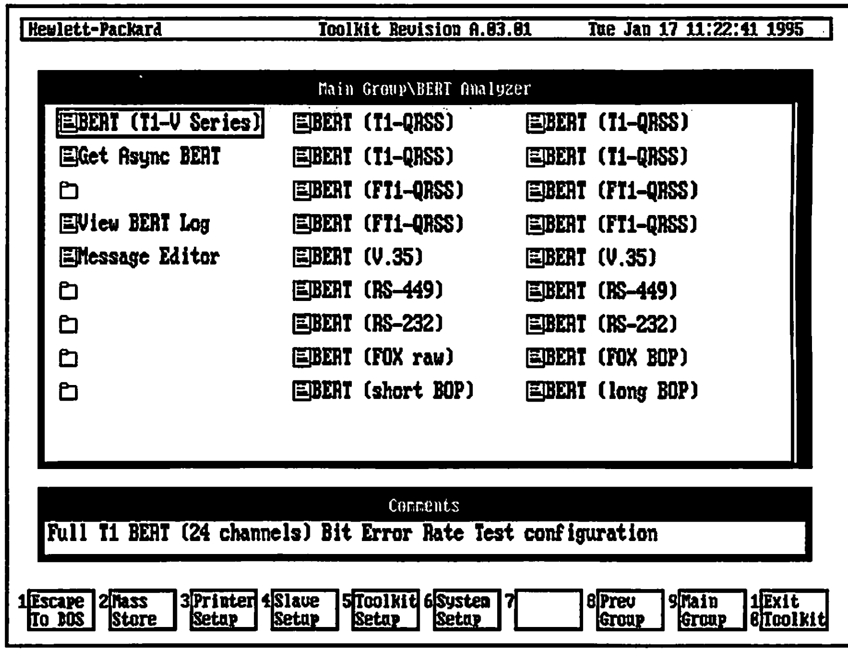


Figure 6-2: T1 Main Group\ BERT Analyzer Screen

The left column of the T1 and E1 Main Group\BERT Analyzer screens provide the following four choices:

BERT (T1-V Series) or BERT (E1-V Series): This is the most general of all the BERT Analyzer setups. Use this menu choice if you want to configure every detail of a BERT test.

Get Async BERT: Starts the internal Low Speed protocol analyzer and performs BERT testing with that system of hardware and software. Refer to "BERT Measurements" in the HP *Low Speed Internet Advisor User's Guide*.

View BERT Log: Allows you to view the results of previous BERT tests. Refer to the section "Viewing the BERT Log" at the end of this chapter for more information.

Message Editor	Allows you to define, store and retrieve test patterns up to 996 bytes long. Refer to the section "Using the Message Editor" at the end of this chapter for more information.

NOTE

The High Speed BERT Analyzer performs synchronous bit error rate tests with a speed of from 50 bps to 2048 Kbps. The Low Speed protocol analyzer capability of the Internet Advisor can perform synchronous, isochronous, and asynchronous BERT tests from 50 bps to 64 Kbps. The most common application for asynchronous BERT is for testing V.22, V.32, and similar asynchronous modems.

The middle and right hand columns of the T1 and E1 Main Group\BERT Analyzer screens list preconfigured (factory-supplied) BERT Analyzer tests. These tests have already been configured to run common BERT tests. You can use these tests as is, or you can modify these tests. If you modify them, you can save your modifications and add them to Toolkit. Refer to chapter 7, "The Toolkit User Interface," for more information about adding tests to Toolkit.

The T1/V-Series preconfigured tests are described in the Tables 6-3 and 6-4. The E1/V-Series preconfigured tests are described in the Tables 6-5 and 6-6.

Table 6-3: Preconfigured T1/V-Series BERT Tests, Part 1

Middle Column Test Name	Description
BERT (T1-QRSS)	Full T1 BERT (24 x 56 Kbps channels) D4 - AMI
BERT (T1-QRSS)	Full T1 BERT (24 x 56 Kbps channels) ESF - B8ZS
BERT (FT1-QRSS)	Fractional T1 BERT (timeslot 1 x 56 Kbps Channels) D4 - AMI
BERT (FT1-QRSS)	Fractional T1 BERT (timeslot 1 x 56 Kbps Channels) ESF - B8ZS
BERT (V.35)	V.35 interface using 2^23-1 pattern at Sync clock rate up to 2.048 Mbps
BERT (RS-449)	RS-449 interface using 2^23-1 pattern at Sync clock rate up to 2.048 Mbps
BERT (RS-232)	RS-232 interface using 2^23-1 pattern at Sync clock rate up to 2.048 Mbps
BERT (Fox raw)	V.35 interface using unframed FOX* message with Sync clock
BERT (short BOP)	V.35 interface using BOP framed 5 byte message (Good CRC) with Sync clock

* Unframed FOX message:
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789

Table 6-4: Preconfigured T1/V-Series BERT Tests, Part 2

Right Column Test Name	Description
BERT (T1-QRSS)	Full T1 BERT (24 x 64 Kbps channels) D4 - B8ZS
BERT (T1-QRSS)	Full T1 BERT (24 x 64 Kbps channels) ESF - B8ZS
BERT (FT1-QRSS)	Fractional T1 BERT (timeslot 1 x 64 Kbps channels) D4 - B8ZS
BERT (FT1-QRSS)	Fractional T1 BERT (timeslot 1 x 64 Kbps channels) ESF - B8ZS
BERT (V.35)	V.35 interface using user pattern at Sync clock rate up to 2.048 Mbps
BERT (RS-449)	RS-449 interface using user pattern at Sync clock rate up to 2.048 Mbps
BERT (RS-232)	RS-232 interface using user pattern at Sync clock rate up to 2.048 Mbps
BERT (FOX BOP)	V.35 interface using BOP framed FOX* message (Good CRC) with Sync clock
BERT (long BOP)	V.35 interface using BOP framed 900 byte message (NO CRC) with clock

* BOP framed FOX message:
<Start Flag>THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789 <8A BD> <End Flag>

Table 6-5: Preconfigured E1/V-Series BERT Tests, Part 1

Middle Column Test Name	Description
BERT (E1-2^20)	Full E1 BERT (31 x 64Kbps channels) HDB3 line code - 2^20-1 pattern
BERT (FE1-2^20)	Fractional E1 BERT (timeslot 1 x 64 Kbps channels) HDB3 - 2^20-1 pattern
BERT (V.35)	V.35 interface using 2^23-1 pattern at Sync clock rate up to 2.048 Mbps
BERT (RS-449)	RS-449 interface using 2^23-1 pattern at Sync clock rate up to 2.048 Mbps
BERT (RS-232)	RS-232 interface using 2^23-1 pattern at Sync clock rate up to 2.048 Mbps
BERT (Fox raw)	V.35 interface using unframed FOX * message with Sync clock
BERT (short BOP)	V.35 interface using BOP framed 5 byte message (Good CRC) with Sync clock

*Unframed FOX message:
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789

Table 6-6: Preconfigured E1/V-Series BERT Tests, Part 2

Right Column Test Name	Description
BERT (E1-USER)	Full E1 BERT (31 x 64 Kbps channels) - HDB3 line code - USER pattern
BERT (FE1-USER)	Fractional E1 BERT (timeslot 1 x 64 Kbps channels) - HDB3 line code - USER pattern
BERT (V.35)	V.35 interface using user pattern at Sync clock rate up to 2.048 Mbps
BERT (RS-449)	RS-449 interface using user pattern at Sync clock rate up to 2.048 Mbps
BERT (RS-232)	RS-232 interface using user pattern at Sync clock rate up to 2.048 Mbps
BERT (FOX BOP)	V.35 interface using BOP framed FOX * message (Good CRC) with Sync clock
BERT (long BOP)	V.35 interface using BOP framed 900 byte message (NO CRC) with clock

*FOX BOP message:
<Start Flag>THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789 <8A BD> <End Flag>

BERT Quick Start

Running a BERT test involves three main steps:

- Configuring the physical interface using the Interface Setup Menu. (This step is optional. If you want to run a preconfigured BERT test, you can use its default physical interface configuration.)
- Configuring BERT using the BERT Configuration Menu (This step is optional. If you want to run a preconfigured BERT test, you can use its default BERT configuration.)
- Starting the Bert measurement.

If you are familiar with BER Testing, you can use the following procedure to quickly configure and run a BERT test. Otherwise, refer to the remaining sections of this chapter for more information on configuring and running a BERT test.

NOTE

To make a selection in a configuration field of an Internet Advisor menu, use the Up and Down arrows to move the flashing cursor to the field that you want to change, and then press **ENTER**. Use the Up and Down arrow keys to highlight the desired value in the right window, and then press **ENTER** to put that value into the configuration field. Menus may have more than one page of fields; to access another page, use **PgDn** and **PgUp** or the Up and Down arrow keys.

1. Turn on the Internet Advisor.
2. Highlight **BERT Analyzer** in the Main Group screen of Toolkit (the power-on screen) and then press **ENTER**.
3. Highlight **BERT (T1-V Series)**, **BERT (E1-V Series)**, or one of the preconfigured BERT tests, and then press **ENTER**. If you select one of the preconfigured BERT Tests and you want to use it as is, go to step 5.

4. Configure the physical interface by setting the **Interface Type** field to V.24/ RS-232, V.35, V.36/RS-449, External (for ISDN Basic or Primary rate or X.21), T1 DSX-1, T1 Network Interface, or CEPT E1. Then do one of the following:

   a. If you selected a V-Series or External **Interface Type**, configure **Emulate** mode as DTE or DCE (usually DTE), **DTE Clock Src** as DTE or DCE (usually DCE), **Data Sense** as Normal or Inverted (usually Normal), and **Baud Rate** (50 bps to 2048 Kbps). Then, set the required running **Lead State** (CTS, DSR and CD, or RTS and DTR). Refer to the section "Configuring the V-Series Interfaces," later in this chapter, for more detailed information.

   b. If you selected either T1 **Interface Type**, configure **Emulate** mode as Line or Equipment, **Xmit Clock Src** as Recovered or Internal, **Receiver Mode** as Monitor Jack, Terminated, Bridged or Thru/Drop & Insert, **Line Code*** as AMI or B8ZS. Set **Framing Type*** as ESF, D4 or Unframed and **Data Channel** as Full Frame 24x56 or 24x64, or Fractional Nx56 or Nx64. If you select Fractional, then configure **Eqpt Data chan, Line Data chan, Eqpt Voice chan,** and **Line Voice chan** by using the arrow keys and the Spacebar to select (mark with an asterisk) or deselect (mark with a period) the channels you want to test. Finally, set **LINE** (or **EQPT**) **Xmit Build Out**. Refer to the section "Configuring the T1 Interface," later in this chapter, for more detailed information.

   c. If you selected the E1 **Interface Type**, configure **Emulate** mode as Line or Equipment, **Xmit Clk Src** as Recovered or Internal, **Receiver Mode** as Monitor Jack -20 dB, Monitor Jack -30 dB, Terminated, Bridged, or Thru/Drop & Insert, **Line Code*** as AMI or HDB3. Set **Frame Alignment*** as With CRC-4, Without CRC-4, or Unframed 2048 Kbps, and **Data Channel** as Full Frame 31x64, or Fractional Nx64. If you select Fractional, then configure **Eqpt Data slot, Line Data slot, Eqpt Voice slot,** and **Line Voice slot** by using the arrow keys and the

Spacebar to select (mark with an asterisk) or deselect (mark with a period) the channels you want to test. Refer to the section "Configuring the E1 Interface," later in this chapter, for more detailed information.

* Can be determined by High Speed Analyzer Auto Configure. Refer to chapter 3, "Configuring the Internet Advisor," for more information on Auto configure.

5. Configure BERT by pressing **F9** (BERT), then **F5** (BERT Config). Configure **Pattern, Block Size, Duration, Error Insert Type, Error Insert Rate,** and **Logging**. For T1, also configure **Loop Type** and **Respond to Loop** if remote loop back is desired. Refer to the section "Configuring BERT" for more detailed information.

6. Exit the BERT Configuration Menu by pressing **F10** (Exit to BERT).

7. Press **F9** (Start BERT). BERT runs for the configured duration or until you press **F9** (Stop BERT). The displayed statistics are continuously updated while the test is running. Refer to the section "Running BERT and Understanding BERT Results" for more detailed information.

Configuring the Physical Interfaces

You can configure BERT to run on T1, E1, and V-series physical interfaces by using the T1, E1, and V-series Interface Setup Menus. The Interface Setup Menu is where you make selections that configure the Internet Advisor to match the parameters of the network you are going to test. Refer to the next sections for more details on each configuring each interface.

In each Internet Advisor Interface Setup Menu, **F1** (Help) accesses the Help system and **F4** (Store Setting) lets you save your BERT configuration. Pressing **F3** (Load Setting) lets you load a previously stored configuration, as shown in Figure 6-3. Enter a DOS path and file name in the File Name field and then press **F10** (OK) (or press **ENTER** to browse the disk for the file).

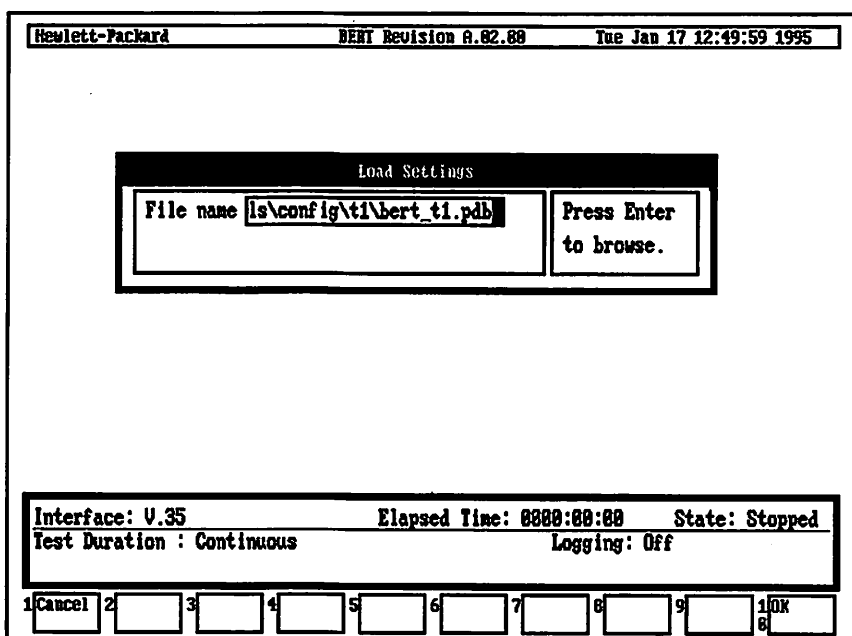


Figure 6-3: Load Settings Screen

Configuring the T1 Interface

The HP J2301A T1 Internet Advisor comes with the T1 Internet Advisor system software loaded and with the T1 interface module installed. You cannot configure the T1 interface without the T1 Internet Advisor system software loaded and the T1 interface module installed.

To configure the T1 interface for T1 BERT testing, from the Main Group screen of Toolkit (the Internet Advisor's power-on screen), use the arrow keys to highlight **BERT Analyzer** and press **ENTER**. This opens the T1 Main Group\BERT Analyzer screen. Selecting any of the tests labeled BERT (...) displays the Interface Setup Menu. The exact appearance of the Interface Setup Menu depends upon which BERT test you select. Figure 6-4 shows how Page 1 of the Interface Setup Menu looks if you select the BERT (T1-V Series) test.

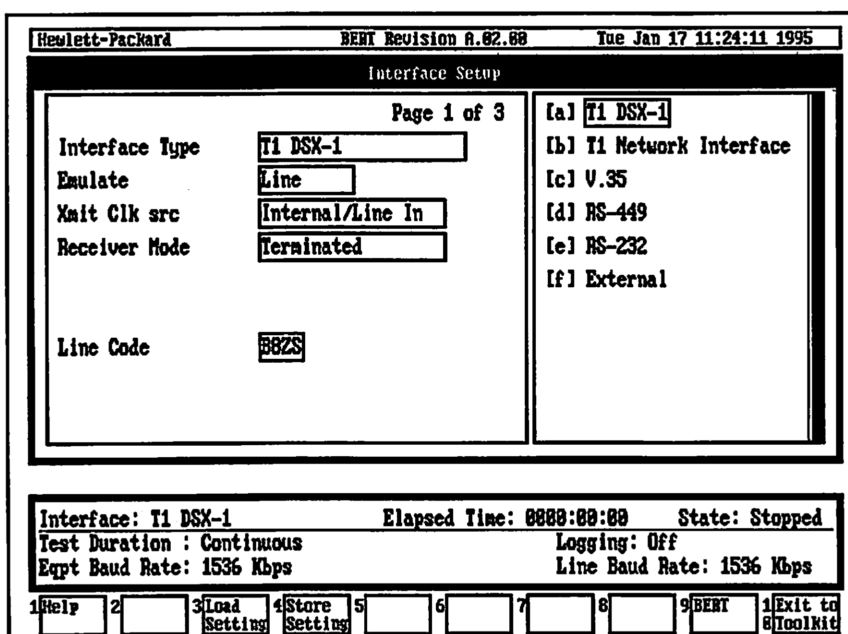


Figure 6-4: T1 Interface Setup Menu (Page 1 of 3)

NOTE

When entering the Interface Setup Menu the first time, the transmitter is OFF. The transmitter is first activated by pressing **F9** (BERT), and then **F9** (Start BERT). The transmitter remains active, even after pressing **F9** (Stop BERT), until the **Interface Type** field is changed and you press **F9** (BERT) again, which turns OFF the transmitter.

These are the fields you can configure in the T1 Interface Setup Menu for T1 BERT testing:

Interface Type - This is the first field you should configure, because the selection you make for this field affects what other fields and choices are available. To run a T1 BERT test, choose one of the following:

T1 DSX-1	T1 Interface at cross-connect signal levels (Inside).
T1 Network Interface	T1 Interface at line signal levels (Outside).

Emulate - These are your choices for this field:

Line	Emulate the central office.
Equipment	Emulate the customer equipment.

Xmit Clk src - If the **Emulate** field is set to Line, then the following are your choices for the Transmit Clock Source:

Recovered Eqpt	Clocking is derived from the incoming Equipment signal.
Internal/Line In	Clocking is derived from the incoming Line signal or, in its absence, self-generated independent clocking.

If the **Emulate** field is set to Equipment, these are your **Xmit Clk src** choices:

Recovered Line	Clocking derived from the incoming Line signal.
Internal/Eqpt In	Clocking derived from the incoming Equipment signal or in its absence, self-generated independent clocking.

The remaining fields in the Interface Setup Menu for T1 BERT testing are listed below. These fields are the same fields you can configure in the Interface Setup Menu for doing other non-BERT T1 tests. For more information on these fields and their selections, refer to the section "Configuring the T1 Interface" in chapter 3, "Configuring the Internet Advisor."

- **Receiver Mode** - For BERT testing, only the Monitor Jack, Terminated, and Bridged choices are available.
- **Line Code**
- **Framing Type** - For BERT testing, only the ESF, D4, and Unframed 1.544 choices are available.

NOTE Refer to Appendix D, "T1 and E1 Technology Overview," for an explanation of framing. The T1 **Framing Type** field must be properly configured to match the links to be tested. If the configuration is not known, the T1 Auto Configure capability of the Internet Advisor can be used to determine proper parameters. For end-to-end T1 BERT testing, **Framing Type** and **Line Code** must match the parameters of the link from customer premises to the central office. Different **Framing Type** and **Line Code** might be present at opposite ends of a long-haul circuit. Unframed 1.544 Mbps is used primarily on private circuits that do not involve central office cross-connects.

- **Data Channel**
- **Eqpt Data chan**
- **Line Data chan**
- **Eqpt Voice chan**
- **Line Voice chan**
- **LINE Xmit Build Out** or **EQPT Xmit Build Out** (depending on whether the **Emulate** field is set to Line or Equipment)
- **Comment**

Configuring the E1 Interface

The HP J2302A E1 Internet Advisor comes with the E1 Internet Advisor system software loaded and with the E1 interface module installed. You cannot configure the E1 interface without the E1 Internet Advisor system software loaded and the E1 interface module installed.

To configure the E1 interface for E1 BERT testing, from the Main Group screen of Toolkit (the Internet Advisor's power-on screen), use the arrow keys to highlight **BERT Analyzer** and press **ENTER**. This opens the E1 Main Group\BERT Analyzer screen. Selecting any of the tests labeled BERT (...) displays the Interface Setup Menu. The exact appearance of the Interface Setup Menu depends upon which BERT test you selected. Figure 6-5 shows how Page 1 of the Interface Setup Menu looks if you select the BERT (E1-V Series) test.

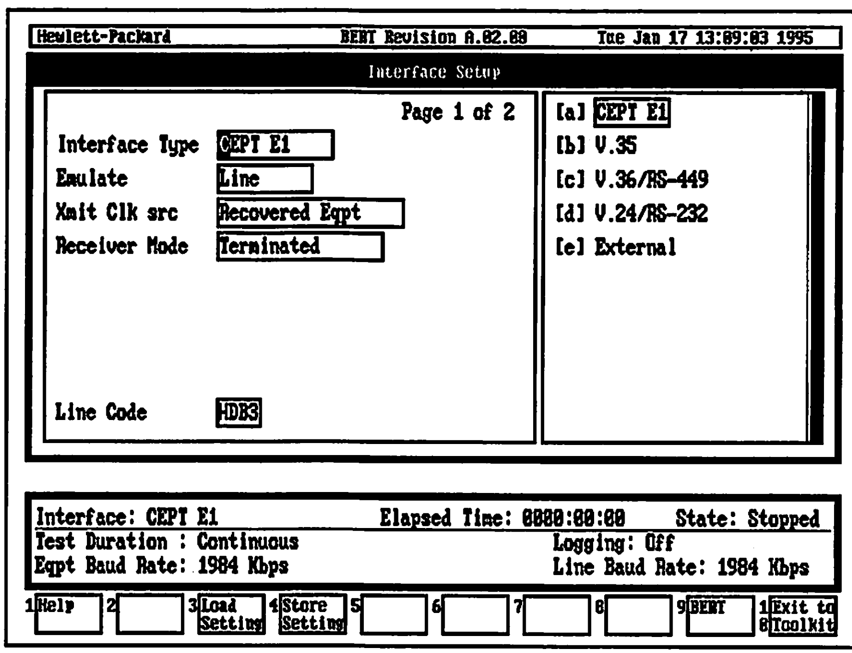


Figure 6-5: E1 Interface Setup Menu (Page 1 of 2)

NOTE

When entering the Interface Setup Menu the first time, the transmitter is OFF. The transmitter is first activated by pressing **F9** (BERT), and then **F9** (Start BERT). The transmitter remains active, even after pressing **F9** (Stop BERT), until the **Interface Type** field is changed and you press **F9** (BERT) again, which turns OFF the transmitter.

These are the fields you can configure in the E1 Interface Setup Menu for E1 BERT testing:

Interface Type - This is the first field you should configure, because the selection you make for this field affects what other fields and choices are available. To run an E1 BERT test, choose CEPT E1.

Emulate - These are your choices for the Emulate field:

Line	Emulate the central office.
Equipment	Emulate the customer equipment.

Xmit Clk src - If the **Emulate** field is set to Line, then the following are your choices for the Transmit Clock Source:

Recovered Eqpt	Clocking is derived from the incoming Equipment signal.
Internal/Line In	Clocking is derived from the incoming Line signal or, in its absence, self-generated independent clocking.

If the **Emulate** field is set to Equipment, these are your **Xmit Clk src** choices:

Recovered Line	Clocking derived from the incoming Line signal.
Internal/Eqpt In	Clocking derived from the incoming Equipment signal or in its absence, self-generated independent clocking.

Receiver Mode - The following are your choices:

Monitor Jack -20dB	Expect the higher amplitude E1 test point signal.

Monitor Jack -30dB	Expect the lower amplitude E1 test point signal.
Terminated	Used when BERT Analyzer is the only device on the near end of the line.
Bridged	No termination, high impedance. Used when another device is on the near end of line. Test cables should be less than 2 meters.
Thru/Drop & Insert	When the **Emulate** field is set to Equipment, the EQPT In signal is regenerated as EQPT Out for the non-selected channels; the selected test signals are inserted on the selected channels; and LINE In is directly connected to LINE Out. When the **Emulate** field is set to Line, the LINE In signal is regenerated as LINE Out for the non-selected channels; the selected test signals are inserted on the selected channels; and EQPT In is directly connected to EQPT Out.

The remaining fields in the Interface Setup Menu for E1 BERT testing are listed below. These fields are the same fields you can configure in the Interface Setup Menu for doing other non-BERT E1 tests. For more information on these fields, refer to the section "Configuring the E1 Interface" in chapter 3, "Configuring the Internet Advisor."

- **Line Code**
- **Frame Alignment** (labeled as the **Framing** field for non-Bert tests)

NOTE

Refer to Appendix D, "T1 and E1 Technology Overview," for an explanation of framing. The E1 **Frame Alignment** field must be properly configured to match the links to be tested. If the configuration is not known, the E1 Auto Configure capability of the Internet Advisor can be used to determine proper parameters. For end-to-end E1 BERT testing, **Frame Alignment** and **Line Code** must match the parameters of the link from customer premises to the central office. Different **Frame Alignment** and **Line Code** might be present at opposite ends of a long-haul circuit. Unframed 2.048 Mbps is used primarily on private circuits that do not involve central office cross-connects.

- **Data Channel**
- **Eqpt Data slot** (labeled **EQ Data Chan** for non-Bert tests)
- **Line Data slot** (labeled **LN Data Chan** for non-Bert tests)
- **Eqpt Voice slot** (labeled **EQ Voice Chan** for non-Bert tests)
- **Line Voice slot** (labeled **LN Voice Chan** for non-Bert tests)

Configuring the V-Series Interfaces

You can configure both a T1 Internet Advisor and an E1 Internet Advisor to run V-Series BERT tests.

To configure for V-Series BERT testing, from the Main Group screen of Toolkit (the Internet Advisor's power-on screen), use the arrow keys to highlight **BERT Analyzer** and press **ENTER**. This opens the Main Group\BERT Analyzer screen. Selecting any of the tests labeled BERT (...) displays the Interface Setup Menu. The exact appearance of the Interface Setup Menu depends upon which BERT test you select.

These are the fields you can configure in the Interface Setup Menu for V-series BERT testing:

Interface Type - This is the first field you should configure, because the selection you make for this field affects what other fields and choices are available. To run a V-Series BERT test, choose one of the following:

V.35	Use the built-in V.35 interface.
RS-449 (on a T1 unit) or V.36/RS-449 (on an E1 unit)	Use the built-in RS-449 interface.
RS-232 (on a T1 unit) or V.24/RS-232 (on an E1 unit)	Use the built-in RS-232 interface.
External	Use an external interface (for example, ISDN or X.21).

Figure 6-6 shows how Page 1 of the Interface Setup Menu looks if you select V.35 for the **Interface Type** field.

CAUTION

The V.35, RS-449, RS-232 and External ports are NOT independent of one another. Only one port of the Internet Advisor should be attached to the network at a time. Multiple port attachments can cause unreliable results.

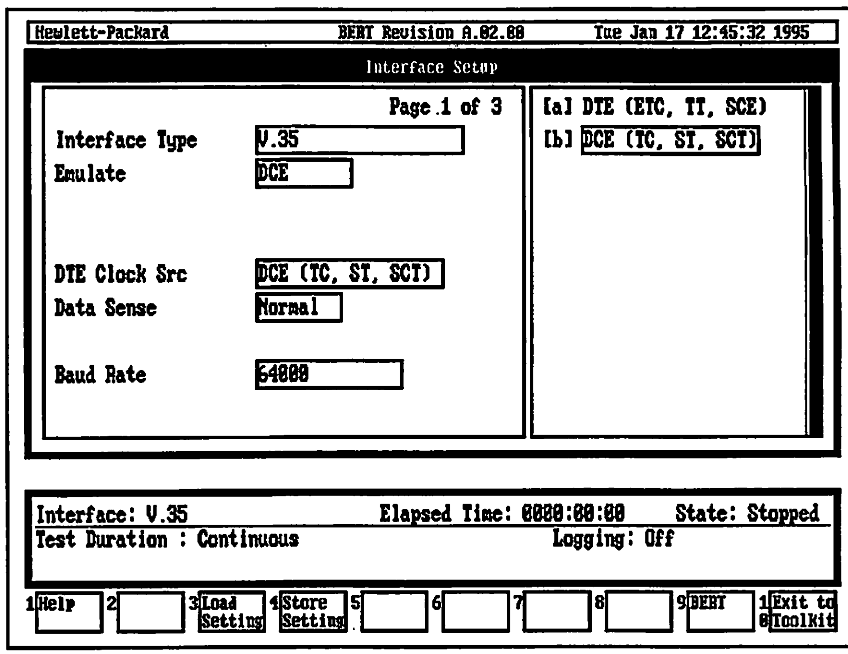


Figure 6-6: T1/Setup Menu (Page 1 of 3)

Once you have selected **Interface Type**, you can make selections for the following fields. These fields are common to all the V-series interfaces:

Emulate - The following are your choices:

DCE	Data Circuit-terminating Equipment (Modems and CSU/DSUs)
DTE	Data Terminal Equipment (User devices)

DTE Clock Src - The V-Series specifications offer a choice for the clocking of transmitted data from Data Terminal Equipment. The Internet Advisor must be configured to match the system clocking to properly detect and decode DTE data. The choices for this field are:

DTE (ETC, TT, SCE)	The terminal device is supplying its own clocking. This is not very common.
DCE (TC, ST, SCT)	The terminal device accepts clocking by the DCE. This is typical in most V-Series connections.

Data Sense - The choices for this field are:

Normal	A Mark represents a binary 1.
Inverted	A Mark represents a binary 0.

Baud Rate - For BERT testing, the range is from 50 bps to 1984 Kbps. Refer to the description of this field in "Configuring the V-series Interfaces" section of chapter 3, "Configuring the Internet Advisor" for more information on each available baud rate.

NOTE

All BERT tests performed by the BERT (T1-V Series) and BERT (E1-V Series) tests are synchronous. Clock signals must be present on the V-Series interfaces. For BERT testing of asynchronous modems and terminal adapters, select **Get Async BERT** in the Main Group\BERT Analyzer screen.

Lead State - When the **Emulate** field is set to DCE, the leads are CTS (Clear To Send), DSR (Data Set Ready), and CD (Carrier Detect). When the **Emulate** field is set to DTE, the leads are RTS (Request To Send) and DTR (Data Terminal Ready). These RS-232 circuit names are used for all the V-series interfaces. You can select On or Off for each lead. The leads become active when the test is first started and then the leads remain in the specified state (On or Off) after the test is stopped.

Comment - This field lets you enter up to 20 characters to describe the setup selections you have made in the Interface Setup Menu. This comment is then stored with the setup selections if you use the **F4** (Store Settings) softkey.

Configuring BERT

After configuring the physical interface in the Interface Setup Menu, press **F9** (BERT) to display the BERT screen. Then press **F5** (BERT Config) to display the BERT Configuration Menu. Figure 6-7 shows the T1 BERT Configuration Menu. The BERT Configuration Menu is similar for E1 and V-series BERT tests.

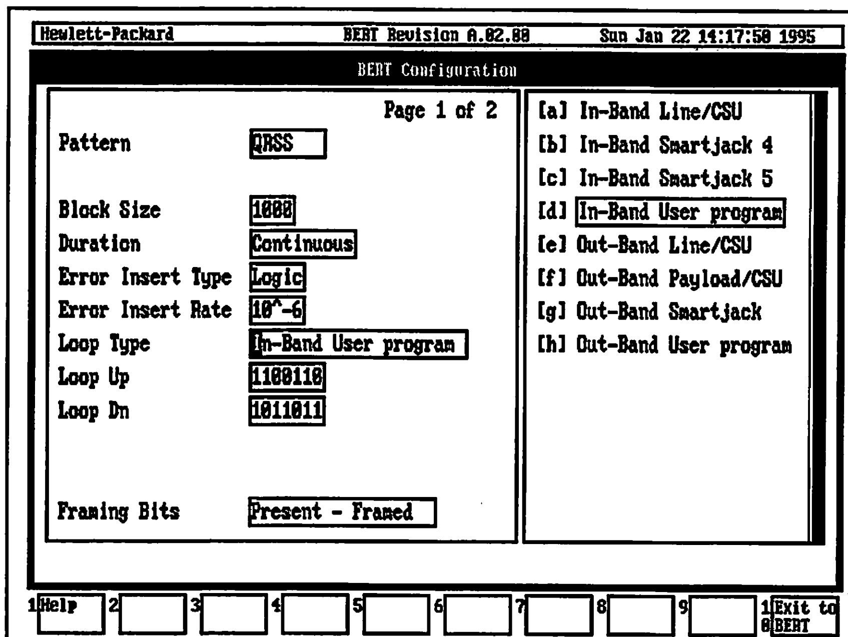


Figure 6-7: T1 BERT Configuration Menu (Page 1 of 2)

Use the following information to configure BERT. When you are done making selections, press **F10** (Exit to BERT) to exit the BERT Configuration Menu and return to the BERT screen.

Pattern - This field lets you choose the BERT pattern. Table 6-7 shows your choices.

Table 6-7: Available BERT Patterns

T1	E1 & V-Series
[a] 63	[a] 63
[b] 511	[b] 511
[c] 2047	[c] 2047
[d] 4095	[d] 4095
[e] 2^15-1	[e] 2^15-1
[f] 2^20-1	[f] 2^20-1
[g] 2^23-1	[g] 2^23-1
[h] QRSS	[h] QRSS
[i] 3 in 24	[i] USER
[j] 1 in 8 (1:7)	[j] All 1's
[k] USER	[k] All 0's
[l] All 1's	[l] 1010...(1:1)
[m] All 0's	
[n] 1010...(1:1)	

If you select User as the pattern, another field, **User Pattern**, appears in which you can specify a hex or text pattern. You can also select a message that has been generated in the Message Editor. For more information on using the Message Editor, refer to "Using the Message Editor," later in this chapter.

Block Size - The following are your choices:

511	Common CCITT/CEPT value.
1000	Common AT&T/North American value.
2047	Common CCITT/CEPT value.

Duration - To obtain statistically significant results, test durations should be long enough to create several tens or even hundreds of block errors. Circuits with low BER need increased time to test. For example, 10^9 bits at 1.544 Mbps takes slightly over 1 hour. To substantiate a 1.0E-009 BER should require a 24 hour test at minimum. The following are your choices:

10^5 bits	(100 000.)
10^6 bits	(1 000 000.)
10^7 bits	(10 000 000.)
10^8 bits	(100 000 000.)
10^9 bits	(1 000 000 000.)
5 mins	
10 mins	
15 mins	
1 hour	
4 hours	
12 hours	
24 hours	
Continuous	

Error Insert Type - You can configure the BERT Analyzer to deliberately insert errors to verify operation of network components. For E1 and V-Series BERT tests, **Error Insert Type** can only be set to Logic. This causes single-bit errors in the pseudo-random bit sequence. For T1 BERT tests, **Error Insert Type** can be one of the following:

Logic	Errors in the pseudo-random bit sequence.
BPV	BiPolar Violations in the AMI encoding.
Frame	Errors in the T1 framing bits.

Error Insert Rate - The following are your choices:

10^-2	1 bit in 100. Not available for T1 or E1.
10^-3	1 bit in 1 000.
10^-4	1 bit in 10 000.
10^-5	1 bit in 100 000.
10^-6	1 bit in 1 000 000.
10^-7	1 bit in 10 000 000.

Loop Type - The selectable values for this field correspond to common methods used in T1 channel service units and line termination units to force the incoming signal to be repeated back. Automatic looping allows you to do single ended testing of an entire data circuit. The following are your choices, and their associated patterns:

In-Band Line/CSU	Loop Up 1000	Loop Down 100
In-Band Smartjack 4	Loop Up 1100	Loop Down 1110
In-Band Smartjack 5	Loop Up 11000	Loop Down 11100
In-Band User program	3- to 7-bit user-defined patterns	
Out-Band Line/CSU	Loop Up 000 111	Loop Down 011 100
Out-Band Payload/CSU	Loop Up 001 010	Loop Down 011 001
Out-Band Smartjack	Loop Up 001 001	Loop Down 010 010
Out-Band User program	6-bit user-defined patterns	

In-Band refers to three- to seven-bit patterns which the Internet Advisor transmits repeatedly for six seconds when you press **F4** (Xmit Loop Up) or **F5** (Xmit Loop Dn) from the BERT screen. These transmissions are made as D4 Super Frames or as unframed patterns. In-Band signaling is mandatory with D4 Framing. There is a Loop Up and a Loop Down pattern for each In-Band selection.

Out-Band refers to 6-bit codes sent for 12 Extended Super Frames in the 4 Kbps ESF data channel. This is the preferred method for signaling Loop Up and Loop Down in ESF circuits. There is a Loop Up and a Loop Down pattern for each Out-Band selection.

NOTE

The Out-Band Loop Up and Loop Down signals are transmitted as 12 repeated 16-bit words. The pattern is of the form `1111 1111 0CCC CCC0` where the `C` bits are set to the code pattern specified.

Loop Up and **Loop Dn** - These fields appear only if In-Band or Out-Band User program is selected for the **Loop Type** field. For In-Band, the user-specified pattern must be from three to seven bits. For Out-Band, the patterns must be exactly six bits.

Framing Bits - This field must be set for In-Band loop signaling. The following are your choices:

Present-Framed	Loop signaling transmitted with D4 framing.
Patterned-Unframed	Loop signaling transmitted without framing. (Used mainly with older T1 devices.)

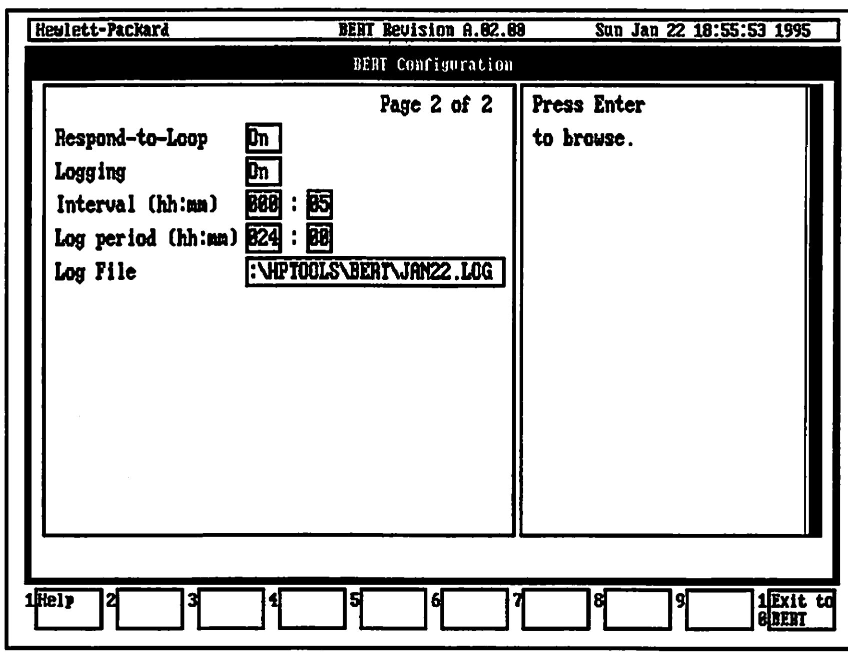


Figure 6-8: T1 BERT Configuration Menu (Page 2 of 2)

Respond-to-Loop - This field is available only for T1 BERT tests. The following are your choices:

On	Respond to remote loop command.
Off	Ignore remote loop command.

Logging - The following are your choices:

Off	The BERT results are not logged.
On	If you set Logging to on, several new fields, **Interval (hh:mm)**, **Log Period (hh:mm)**, and **Log File** appear.

Interval (hh:mm) - You can set **Interval (hh:mm)** between 1 minute and 999 hours 59 minutes. **Interval (hh:mm)** is the length of each single repetitive test. To repeat the test, set **Duration** to Continuous. On circuits with low BER, the Interval Period should be set to tens of hours. Each of these intervals constitutes a single BERT measurement.

Log period(hh:mm) - Set this to some multiple of **Interval. Log period** can be set between 1 minute and 999 hours 59 minutes. This is the period of time that tests will be repeated and logged. For example, if **Interval** is set to 10:00 and **Log Period** is set to 200:00 then 20 tests of 10 hours each will be run and logged.

Log File - Enter a fully qualified DOS file name for the destination BERT log (or press **ENTER** to activate the file browser to look for a file name). The file extension must be .LOG.

Running BERT and Understanding BERT Results

After you have configured the physical interface and you have configured BERT, press **F9** (Start BERT) to run BERT. The test runs for its configured duration or until you press **F9** (Stop BERT). Figures 6-9, 6-10, and 6-11 show sample results for BERT measurements. Figure 6-9 shows a running T1 BERT screen.

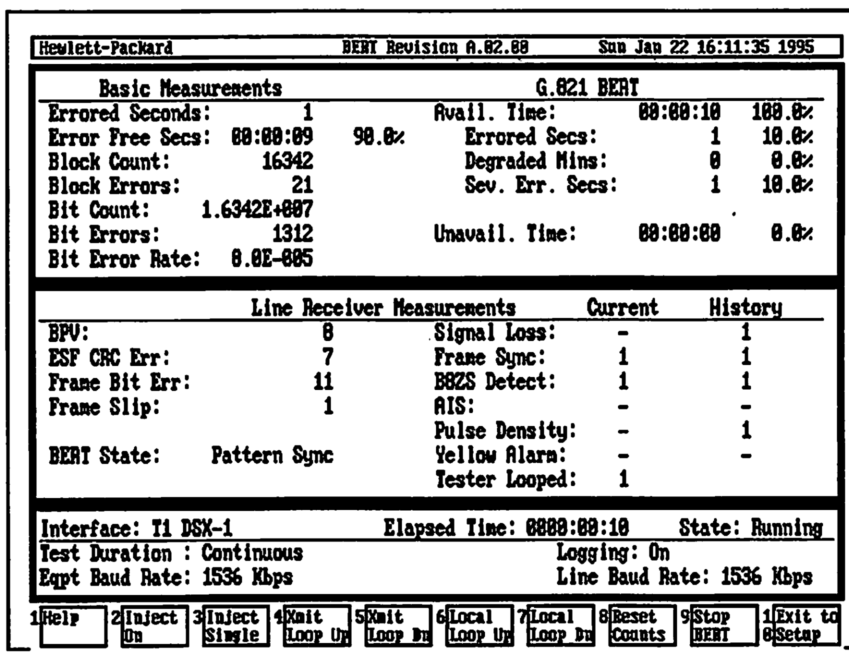


Figure 6-9: T1 BERT Measurement In Progress

The following list describes the softkeys in the T1 BERT screen:

F1 (Help)	Access the Help system.
F2 (Inject On/Off)	Start and stop the preconfigured error generator.
F3 (Inject Single)	Inject a single bit error in the transmitted stream.
F4 (Xmit Loop Up)	Transmit the preconfigured Loop Up signal.
F5 (Xmit Loop Down)	Transmit the preconfigured Loop Down signal.
F6 (Local Loop Up)	Loop the incoming signal back to the transmitter.
F7 (Local Loop Down)	Return to un-looped operation.
F8 (Reset Counts)	Reset all BERT counts and state indicators.
F9 (Stop Bert)	Stop the test and show the results screen.
F10 (Exit to Setup)	Go to the first page of the Interface Setup Menu.

Figure 6-10 shows T1 BERT sample results. This sample test ran five minutes with 1.0E-007 BER injected. The circuit was momentarily opened. The Line Receiver Measurements window shows this created 6083 Bipolar Violations, 9 ESF CRC Errors, 30 Framing Bit Errors, and 1 Frame Slip. BPV (Bipolar Violations), ESF CRC Err (Extended Super Frame Cyclic Redundancy Check Errors), and Frame Slip are all counters totalling the number of each respective occurrence during the course of the test.

Signal Loss, Frame Sync, B8ZS Detec, AIS, Pulse Density, Yellow Alarm, and Tester Looped are state indicators. Current refers to the most recent second, History means that the item has occurred sometime during the test. The indications are 1 (True) and - (False). Refer to Appendix D, "T1 and E1 Technology Overview," for a definition of these T1 terms.

NOTE

Certain test patterns can preclude certain indications. For example, All 1's or 1010...(1:1) patterns show False on B8ZS Detect, an incoming Unframed signal shows Frame Sync False. An incoming Unframed All 1's sets AIS True.

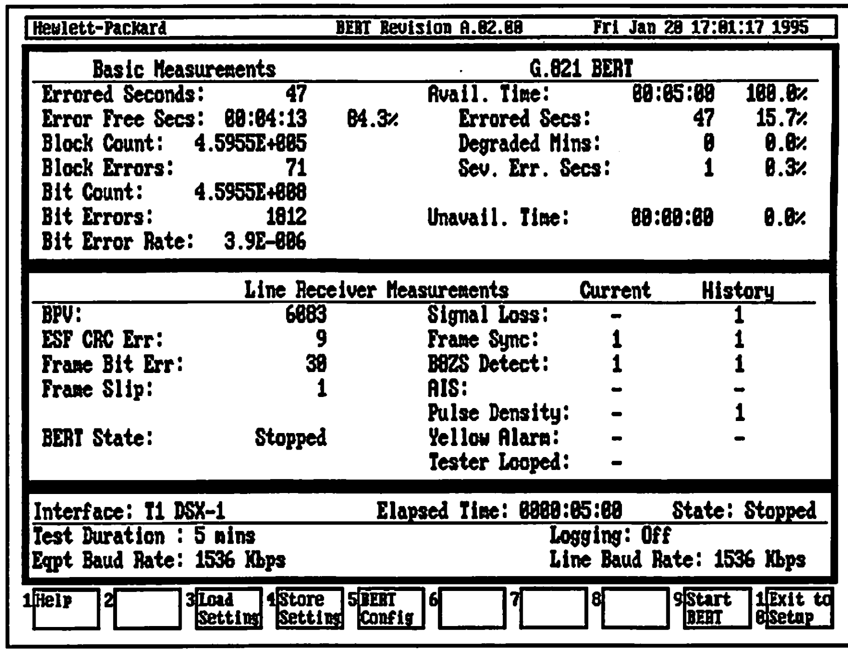


Figure 6-10: T1 BERT Sample Results

Figure 6-11 shows a V.35 BERT sample test with an incoming bit error rate of 1.0E-007. When the test was stopped at five minutes, the data rate was 2048 Kbps and the block size was 511.

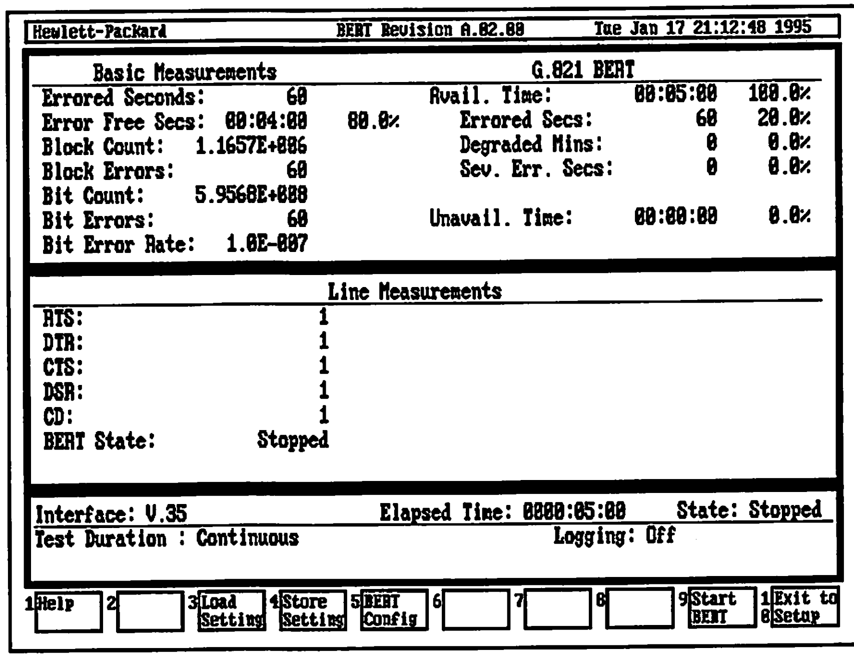


Figure 6-11: V.35 BERT Measurement

BERT Basic Measurements - The following are the BERT Basic Measurements:

Errored Seconds	Number of seconds with at least 1 bit error.
Error Free Seconds	Number of seconds with no errors. Also expressed as a percentage.
Block Count	Number of blocks of the configured size.
Block Errors	Number of blocks with at least 1 bit error.
Bit Count	Total number of bits received.
Bit Errors	Number of bits received in error.
Bit Error Rate	Bit Errors divided by Bit Count.

G.821 Measurements - The following are the BERT G.821 Measurements:

Avail. Time	Available Time. Number of seconds in which the Bit Error Rate has been less than 1.0E-003 for 10 seconds or more.
Errored Secs	Errored Seconds. Number of seconds with at least 1 bit error and with a BER less than 1.0E-003. (G.821 Errored Seconds plus G.821 Severely Errored Seconds equals Errored Seconds in the basic measurement.)
Degraded Mins	Degraded Minutes. Number of one minute intervals in which the mean Bit Error Rate has exceeded 1.0E-006.
Sev. Err. Secs	Severely Errored Seconds. Number of one second intervals when the Bit Error Rate has been greater than 1.0E-003. Each Severely Errored Second decreases Available Time by one second.
Unavail. Time	Elapsed Time minus Avail. Time.
Elapsed Time	The length of time since the test began or since the most recent press of **F8** (Reset Counts).

Line Measurements - For the sample results shown in Figure 6-11, Line Measurements show that RTS, DTR, CTS, DSR, and CD are all ON. The following are the presentation for control signals:

1	ON
0	OFF

State descriptions - The following are the BERT State descriptions:

Stopped	Statistics are not being accumulated.
Waiting	Receiver is waiting to synchronize.
Pattern Sync	The expected pattern has been received and statistics are being collected.

Viewing the BERT Log

Use the following procedure to view a BERT log:

1. Highlight **View BERT Log** in the Main Group\BERT Analyzer screen and press **ENTER**. Figure 6-12 shows the resulting Examine Data Application Menu.

2. Enter a complete DOS path and file name for the log file in the **Drive/File Selection** field of the Examine Data Application Menu (or press **ENTER** to browse the disk for the file name). Default is the only choice for the **Layer Two Protocol** field. After a file has been selected, file information is shown in the lower part of the window.

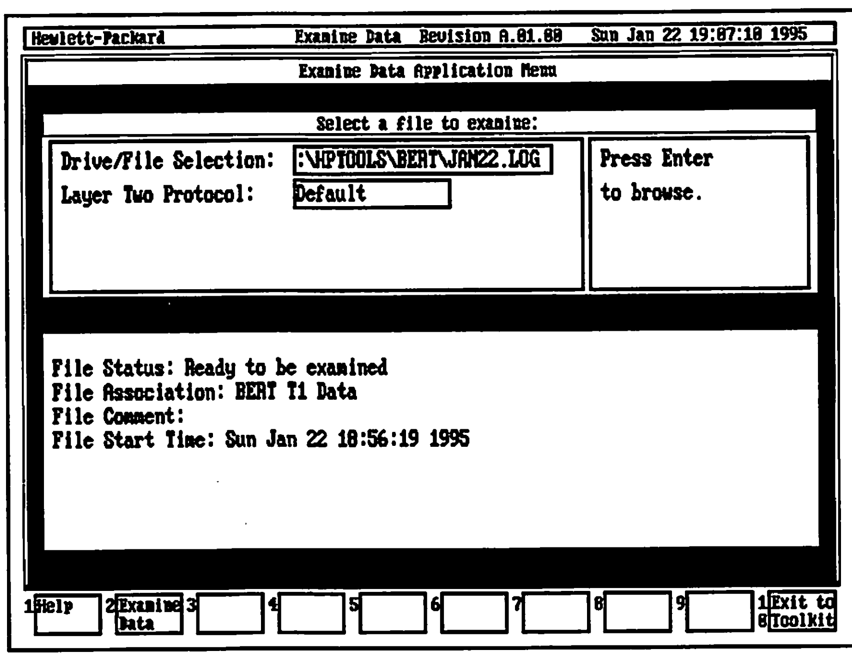


Figure 6-12: Examine Data Application Menu

3. Press **F2** (Examine Data) to view the Interface Setup Menu as it was configured at the time the data was logged. A sample screen is shown in Figure 6-13.

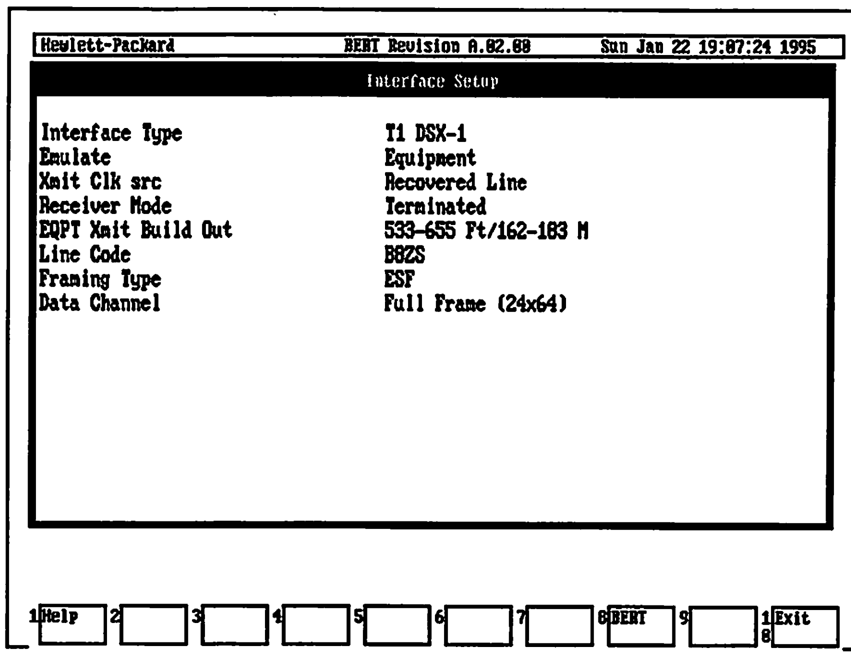


Figure 6-13: Logged Interface Setup

4. Press **F8** (BERT) to view the sample logged BERT data as shown in Figure 6-14.

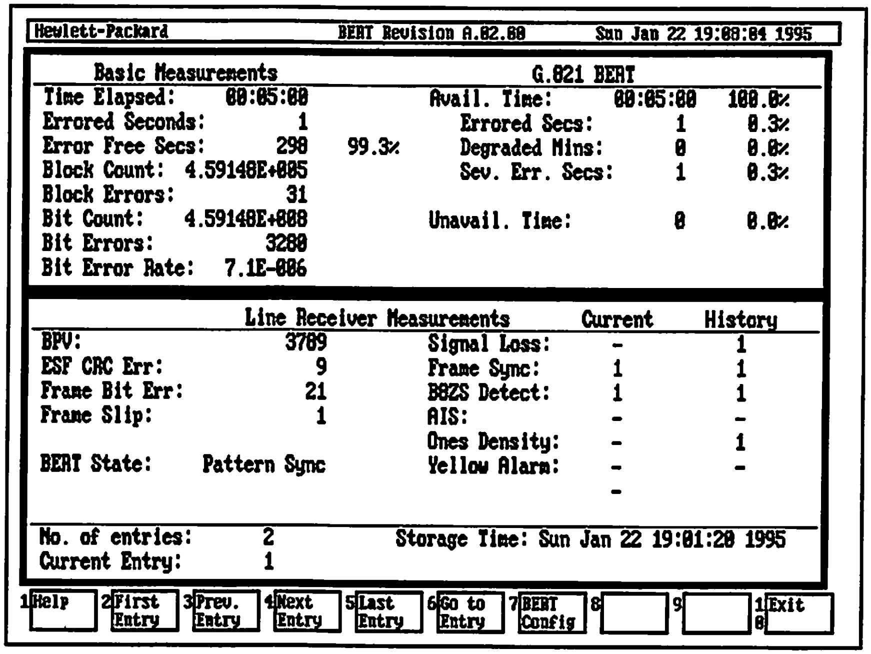


Figure 6-14: Logged BERT Data

5. Use **F2** (First Entry), **F3** (Prev. Entry), **F4** (Next Entry), **F5** (Last Entry), and **F6** (Go to Entry) for navigation through the samples. The **PRTSC** (Print Screen) key can be used to print selected screens to a specified printer.

6. Pressing **F7** (BERT Config) shows how BERT was configured at the time the test was run. Figure 6-15 shows how BERT was configured for the previous sample test results.

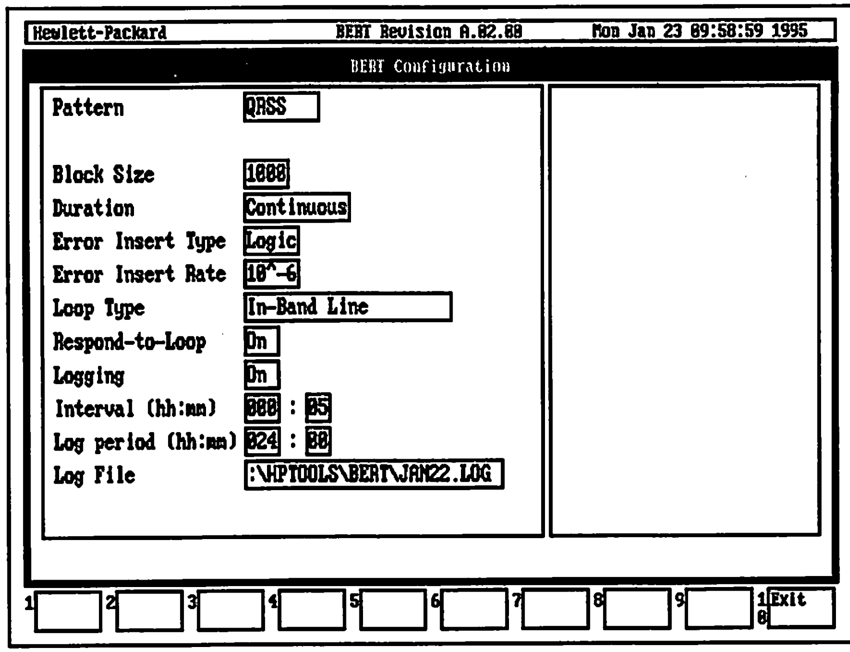


Figure 6-15: Logged BERT Configuration

Using the Message Editor

To use the Message Editor, highlight **Message Editor** in the Main Group\BERT Analyzer screen and press **ENTER**.

Figure 6-16 shows a sample User-Defined Message. The Message Editor allows you to construct octet-based messages up to 996 octets in length. You can enter the messages as text or as hexadecimal character codes.

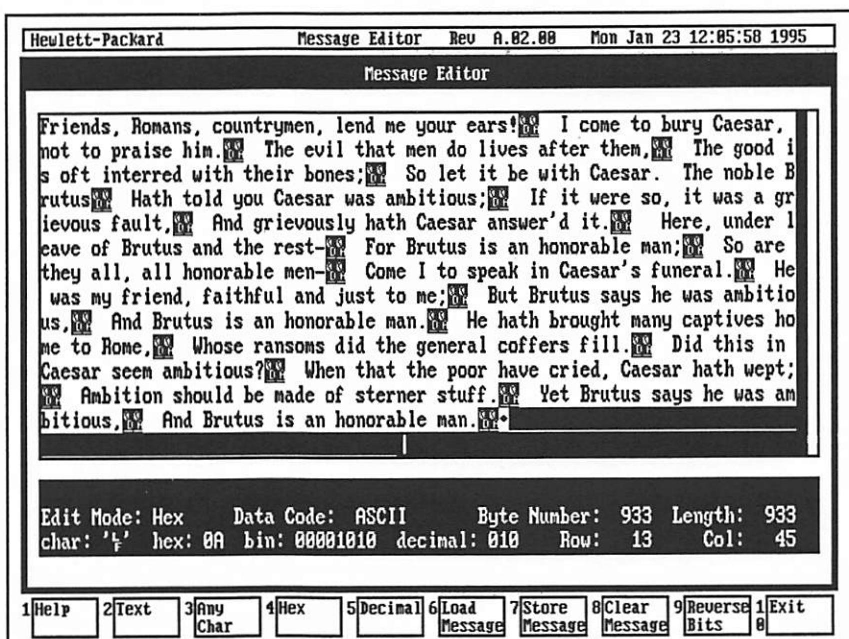


Figure 6-16: Message Editor

The following softkeys are available from the Message Editor screen:

F1 (Help)	Invoke the Help system.
F2 (Text)	ASCII coded characters from keyboard.
F3 (Any Char)	Not applicable to BERT messages.
F4 (Hex)	Octet entry with hexadecimal codes.
F5 (Decimal)	Octet entry with decimal codes.
F6 (Load Message)	Retrieve a previously stored message.
F7 (Store Message)	Save this message.
F8 (Clear Message)	Clear this message.
F9 (Reverse Bits)	Change the transmitted bit order of each octet.
F10 (Exit)	Return to Main Group\BERT Analyzer menu.

NOTE

All data is created as 8-bit ASCII with the most significant bit always 0.

7

The Toolkit User Interface

The Internet Advisor operates with a user interface called the Toolkit. The Toolkit can be customized for your specific testing needs. For example, you can modify the supplied Internet Advisor tests and you can add new tests. You can also add compatible DOS software to the Toolkit.

The Toolkit

An example of the Internet Advisor's power-on or top-level screen, Main Group, is shown in Figure 7-1.

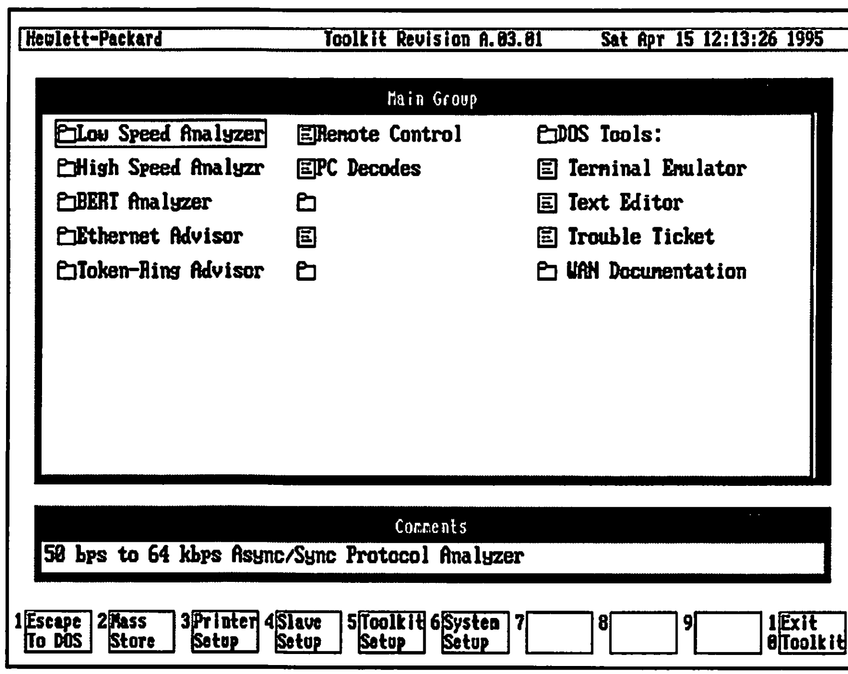


Figure 7-1: Internet Advisor's Power-on Screen

Like many of the Toolkit screens, the Main Group screen has three sections:

- The main (top) window, which is labeled with the title of the screen. The main section of a screen is where you make selections.
- The smaller Comments (bottom) window, which gives information about the current screen or about the currently selected (highlighted) item in the screen.

- The softkeys, which are activated by pressing the **F1** through **F10** function keys.

To move around in a Toolkit screen, use the Up, Down, Left, and Right arrow keys and the **PgUP**, **PgDn**, **HOME**, and **END** keys.

Each of the items in the Main Group screen (and other, similar Toolkit screens) has one of two possible icons:

- - The file-folder icon marks items that access groups of tests. Highlighting a file-folder icon and pressing **ENTER** displays the individual tests within that group, or displays additional groups. For example, selecting **High Speed Analyzr** opens the Main Group\High Speed Analyzer screen, in which there are other file-folder icons and page icons that access tests for various protocols such as HDLC, X.25, and Frame Relay.
- - The page icon marks items that access a single tool or test. Highlighting a page icon and pressing **ENTER** starts the indicated function. For example, selecting **Text Editor** starts the MS-DOS editor.

NOTE Appendix B, "Supplied Tests," describes each of the tests and groups of tests available in the Main Group\High Speed Analyzer screen.

The softkeys in the Main Group provide the following functions:

F1 (Escape to DOS) Lets you go to DOS and perform work without closing Toolkit. Type `Exit` at the DOS prompt when you want to return to the Toolkit menu.

F2 (Mass Store) Lets you perform various file and disk functions. Refer to the section "Mass Store Functions," later in this chapter, for more information.

F3 (Printer Setup) Lets you set printer types and ports for printing things like data or setups. Refer to the section "Configuring a Printer," later in this chapter, for more information.

F4 (Slave Setup)	Lets you set up a slave for remote operations. Refer to the section "Configuring a Slave for Remote Operation," later in this chapter, for more information.
F5 (Toolkit Setup)	Lets you configure Toolkit to add tests or special applications, to automatically run tests, and to delete tests. Refer to the section "Customizing Toolkit," later in this chapter, for more information.
F6 (System Setup)	Lets you select sound options and the video mode. It also shows the operating system version, the machine type, and the available memory. Refer to the section "Configuring the Internet Advisor's Sound," later in this chapter, for more information.
F8 (Prev Group)	Returns you to the previous (higher-level) Toolkit screen. For example, pressing **F8** (Prev Group) from the Main Group\High Speed Analyzr screen takes you back to the Main Group screen.
F9 (Main Group)	Returns you to the Main Group screen.
F10 (Exit Toolkit)	Lets you to close the Toolkit and go to DOS.

NOTE

After you have exited Toolkit by pressing **F10** (Exit Toolkit), to re-start the Toolkit from DOS, type `hptools` at the DOS prompt.

In addition to Toolkit screens like the Main Group screen, many of the Internet Advisor's screens contain fields in which you can make a selection. These screens are generally referred to as menus. Figure 7-2 shows an example, the Interface Setup Menu.

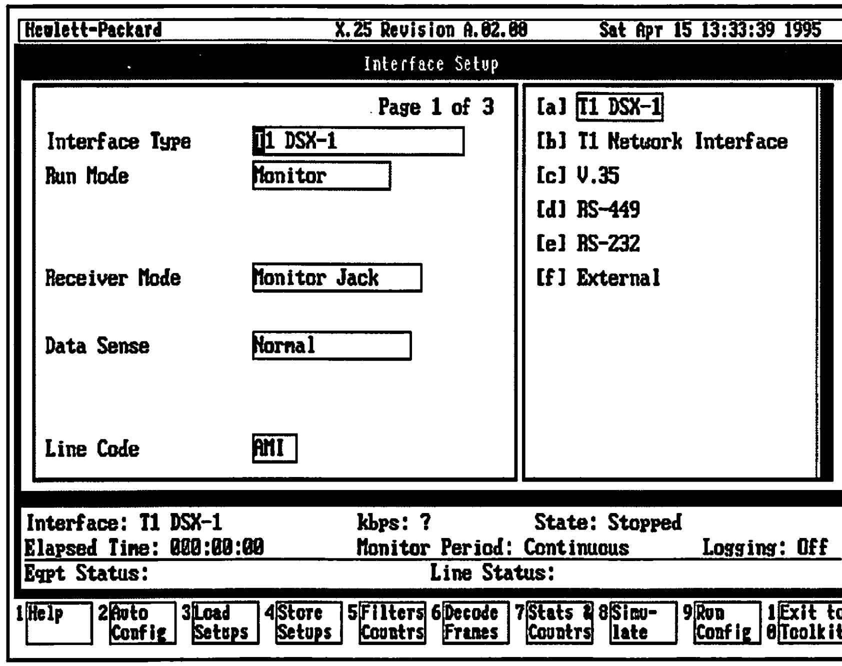


Figure 7-2: Interface Setup Menu

When you enter a Toolkit menu, the left window shows configuration fields and the right window shows the choices (or values) for these fields.

Use the following procedure to make a selection for a configuration field in any Toolkit menu:

1. Use the Up and Down arrow keys to move the flashing cursor to the field you want to change (such as **Interface Type**), and then press **ENTER**.

This highlights the first of the available choices in the right window.

2. Highlight the desired value in the right window by using the Up and Down arrow keys and then press **ENTER**.

   or

   For fields that require you to enter a value, type in your value and then press **ENTER**.

   Doing either of these configures the field selected in step 1 to the value selected in this step and returns the flashing cursor to the left window.

3. Repeat steps 1 and 2 for each configuration field that you want to change.

NOTE

Many menus have more than one page of fields. The number of pages a menu has is indicated in the upper right-hand corner of the menu. For example, Figure 7-2 shows the first of three pages of the Interface Setup Menu. Use **PgDn** and **PgUp** or the Up and Down arrow keys to move to another page.

Customizing Toolkit

You can customize the Toolkit in the following ways to suit your needs:

- Add a test (single program) or a group of tests
- Delete a test or a group of tests
- Modify existing tests and groups
- Copy and Paste tests and groups

In addition, if you have modified any tests that contain simulate programs, you can restore the simulate programs to their original, factory-supplied state. Refer to the section "Restoring Modified Simulate Programs to Their Original State" for more information.

Adding Your Own Tests to the Toolkit

As Appendix B, "Supplied Tests," explains, the Internet Advisor comes with a variety of generic and preconfigured tests. If you frequently need to modify either a preconfigured or a generic test before you use it, you can make your modifications, save your modifications to a file, and then use the file to create a new test in the Toolkit. If you do this, you won't need to modify the supplied test every time you want to run your unique version of it.

1. Select the generic or preconfigured test you want to modify in order to create your own test. For example, in the Main Group\High Speed Analyzr screen, select the generic X.25 test by highlighting the **X.25** page icon (☰) and pressing **ENTER**.

2. Set the **Interface Type** field and the other fields in the Interface Setup Menu to match the network you are going to test. Refer to chapter 3, "Configuring the Internet Advisor," for more information on using the Interface Setup Menu.

3. Make any necessary changes to the Decode Configuration Menu. Refer to chapter 4, "Monitoring," for information on Decode Configuration.

4. Make any necessary changes to the filters/counters. Refer to the section "Filters and Counters" in chapter 3, "Configuring the Internet Advisor," for information on filters and counters.

5. Make any necessary changes to the Run Configuration Menu. Refer to the section "Run Configuration" in chapter 3, "Configuring the Internet Advisor," for more information.

6. If you are going to simulate, create your simulation program. Refer to chapter 5, "Simulating," for more information on simulation programs.

7. Once you have modified the configuration of the existing test to meet your needs, press **F4** (Store Setups) in the Interface Setup Menu. The Store Setups Menu opens displaying the path and file name of the original test's configuration file. For example, for the generic X.25 test on a T1 Internet Advisor, `C:\HPTOOLS\CONFIG\T1\X25_T1.PDB` is shown in the **File Name** field.

8. Enter a path and file name for your modified version of the test. Your file name must have a `.pdb` extension.

   or

Press **ENTER** if you want to browse through the various directories. Another menu appears that shows the disk drive and directory you are currently in. Use the function keys, the arrow keys, and **ENTER** to go to the directory and file name you want, and then press **F10** (Select) to put that path and file name into the **File Name** field.

NOTE

If you are modifying a generic test, you can use the original test's .pdb file name and path; however, this is not recommended.

If you are modifying a preconfigured test, you cannot use the original test's . pdb file name and path (unless it contains a simulate program), because it is write-protected. However, the act of modifying a preconfigured write-protected test and saving its setup to a new .pdb file name removes its write-protected status. The DOS attrib command can be used to restore the .pdb file to read-only status.

NOTE

If you do modify a preconfigured supplied test that contains a simulate program, and you save the test to its original file name, you can restore the simulate program to its original, factory-supplied state. Refer to the section "Restoring Modified Simulate Programs to Their Original State" for more information.

9. Press **F10** (OK) once you have entered the path and file name. The current settings of the Interface Setup Menu, the Run Configuration Menu, the Decode Configuration Menu, the filters and counters, and the simulation program (if one exists) are saved to the .pdb file.

10. Press **F10** (Exit to Toolkit) and then **ENTER** (for yes) to exit the test.

11. Press **F5** (Toolkit Setup) from the Toolkit screen in which you want to add your test. This opens the Toolkit Setup screen.

12. Highlight the test or group that is just before the position where you want your test to be. When the test is added, any existing tests or groups are shifted (in a horizontal wrap-around fashion) to make room for the new test.

13. Press **F1** (Add Program). This opens the Program Information Menu.

14. Type information into the following fields of the Program Information Menu. Use the arrow keys to move between the fields.

    a. **Label** - Enter the name of your new test in this field. The name you type in this field is displayed, along with a page icon (), when the test is added. For example, you could enter `My X.25 Test`.

b. **Program Path** - In this field, you must specify the path and file name from the list below which corresponds to the type of test you modified to create your own test. For example, if you modified the generic X.25 test on a T1 Internet Advisor, you would enter **C:\HPTOOLS\TOOLS\X25_T1.HPE**.

- for T1 BOPs (HDLC) tests, C:\HPTOOLS\BOP_T1.HPE
- for T1 X.25 tests, C:\HPTOOLS\X25_T1.HPE
- for T1 Frame Relay tests, C:\HPTOOLS\FR_T1.HPE
- for T1 SMDS tests, C:\HPTOOLS\SMDS_T1.HPE
- for E1 BOPs (HDLC) tests, C:\HPTOOLS\BOP_E1.HPE
- for E1 X.25 tests, C:\HPTOOLS\X25_E1.HPE
- for E1 Frame Relay tests, C:\HPTOOLS\FR_E1.HPE

c. **Parameters** - In this field, you specify the path and file name of the .pdb file you created in steps 7 through 9 when you used **F4** (Store Setups) to save your configuration changes. Type the path and file name including the .pdb extension.

or

If you do not remember the exact path and file name, or if you want to make your test automatically start when you select it, press **ENTER**. The Card Setup Menu is displayed:

i. Do not change the **Hardware Configuration**, the **High Speed Card Address**, the **Low Speed Card Address**, or the **Low Speed Card Number** field.

ii. If you want your test to automatically start when you select it, use the Down Arrow to highlight the **Auto-Run** field and select On. A new field, **Default Runtime Screen**, appears.

iii. In the **Default Runtime Screen** field, select Decode Frames, if you want the Decode Display to be displayed as soon as the test starts, or select Statistics, if you want the Statistics and Counters screen to be displayed as soon as the test starts.

iv. In the **Configuration File Name** field, type the path and file name of the .pdb file you created in steps 7 through 9.

or

Press **ENTER** to browse the disk for the path and file name. Use the function keys, the arrow keys, and **ENTER** to go to find your .pdb file, and then press **F10** (Select) to put that path and file name into the **Configuration File Name** field.

v. Press **F10** (OK) to close the Card Setup Menu.

d. **Start-up Directory** - Filling in this field is optional. It specifies where the newly added test runs from. Type in a path.

or

Press **ENTER** to browse through the various directories. This opens another menu which shows the disk drive and directory you are currently in. Use the function keys and arrow keys to highlight the Start-up Directory you want, and press **F10** (Select) to select it.

e. **Comments** - You can type in a comment that you want to be displayed in the Comments section of the Toolkit screen when the Label of your new test is highlighted. For example, you could enter `My 5/15/95 version X.25 Test.`

15. Press **F10** (OK) to leave the Program Information Menu and add the test, or press **F1** (Cancel) if you want to cancel adding the new test. Pressing either of these keys takes you back to the Toolkit Setup screen.

16. Press **F10** (Exit Setup). The new Toolkit configuration is saved and you are returned to the Toolkit screen where you started from.

NOTE

If instead of adding a new test to the Toolkit, you want to add an executable program, such as a batch file, to the Toolkit, you can still follow all the steps in the previous procedure with the following exceptions:

For step 14b, enter the path and file name of the executable program in the **Program Path** field. Make sure the file name you enter has the proper extension of .exe, .com, or .bat.

For step 14c, you can put anything in the **Parameters** field that would normally follow the program name entered in the **Program Path** field, because what you specify in the **Parameters** field is preceded by a space and then appended after the string in the **Program Path** field. For example, many text editors allow calling the editor with the file to be edited immediately following the program name. In such a case, if the program name were `myeditor.exe` and the parameter were `myfile.txt`, you would specify `myeditor.exe` in the **Program Path** field and `myfile.txt` in the **Parameters** field.

Adding a Group to the Toolkit

Use the following procedure to add a group of tests to the Toolkit:

1. Press **F5** (Toolkit Setup) from the Toolkit screen in which you want to add the group of tests. This opens the Toolkit Setup screen.

2. Highlight the test or group that is just <u>before</u> the position where you want the new group to be added. When the group is added, any existing tests or groups are shifted (in a horizontal wrap-around fashion) to make room for the new group.

3. Press **F2** (Add Group). This opens the Group Information Menu.

4. Type information into the following fields of the Group Information Menu. Use the arrow keys to move between the fields.

   a. **Label** - The name you type in this field is displayed, along with a file-folder icon (🗀), when the new group is added.

b. **Comments** - You can type in a comment that you want to be displayed in the Comments section of the Toolkit screen when the Label is highlighted.

5. Press **F10** (OK) to leave the Group Information menu and add the new group, or press **F1** (Cancel) to cancel adding the new group. Pressing either of these keys takes you back to the Toolkit Setup screen.

6. Press **F10** (Exit Setup). The new Toolkit configuration is saved and you are returned to the Toolkit screen where you started from.

Deleting a Test or Group from the Toolkit

Use the following procedure to delete a test or group:

1. Press **F5** (Toolkit Setup) from the Toolkit screen which contains the test or group you want to delete. This opens the Toolkit Setup screen.

2. Highlight the test or group that you want to delete.

3. Press **F3** (Delete).

4. Confirm that you want to delete the selection by pressing **ENTER** (OK).

   or

   Press the right arrow to highlight **Cancel,** and then press **ENTER** to cancel the deletion.

5. Press **F10** (Exit Setup). The new Toolkit configuration is saved and you are returned to the Toolkit screen where you started from.

Modifying a Test or Group in the Toolkit

One way to set up a new test in the Toolkit is to modify an existing test or group. Use the following procedure to modify a test or group:

1. Press **F5** (Toolkit Setup) from the Toolkit screen which contains the test or group you want to modify. This opens the Toolkit Setup screen.

2. Highlight the test or group that you want to modify.

3. Press **F4** (Modify) to display the Program Information Menu (if you are modifying a test) or the Group Information Menu (if you are modifying a group).

4. Use the arrow keys to move between the fields and enter your choices. Refer to the section "Adding Your Own Tests to the Toolkit" for more information on the fields in the Program Information Menu. Refer to the section "Adding a Group to the Toolkit" for more information on the fields in the Group Information Menu.

5. Press **F10** (OK) to accept the modifications, or press **F1** (Cancel) to cancel the modifications. Pressing either of these keys takes you back to the Toolkit Setup screen.

6. Press **F10** (Exit Setup). The new Toolkit configuration is saved and you are returned to the Toolkit screen where you started from.

Copying and Pasting a Test or Group in the Toolkit

Another easy way to add a test or group is to copy an existing test or group and then paste it where you want the new test or group. You can then edit this new copy to create your new test or group.

1. Press **F5** (Toolkit Setup) from the Toolkit screen which contains the test or group that you want to copy. This opens the Toolkit Setup screen.

2. Highlight the test or group that you want to copy, and then press **F5** (Copy).

3. Highlight the test or group just before the position where you want to insert the new test or group. When the test or group is added, any existing tests or groups are shifted (in a horizontal wrap-around fashion) to make room for the new test or group.

4. Press **F6** (Paste) to insert the test or group.

NOTE

You can press **F6** (Paste) more than once to make multiple copies of a test or group. You can also copy and paste individual tests from one group to another, or from the Main Group into a group menu.

5. Press **F10** (Exit Setup). The new Toolkit configuration is saved and you are returned to the Toolkit screen where you started from. You can then edit the new group or test.

NOTE

When a write-protected supplied test is copied, the `.pdb` file for the copied test is the same as the `.pdb` file for the original test. The act of copying a write-protected test removes its write-protected status. The DOS attrib command can be used to restore the .pdb file to read-only status.

Restoring Modified Simulate Programs to Their Original State

Most of the tests supplied with the Internet Advisor are write-protected. This forces you to save modifications made to supplied tests in files with new names. However, since the HP-supplied simulate programs may require some modifications to function properly, they are not write-protected. You can use the following procedure to restore all HP-supplied simulate programs to their original state:

CAUTION

If you have modified any supplied simulate programs without saving them to a new file name, and you use the following procedure, you will loose your custom programs. To save your custom programs, copy them to new file names prior to using the following procedure.

1. Press **F10** (Exit Toolkit) from the Main Group screen, and then select `YES` to go to the DOS prompt.

2. Type **`simrest`** and then press **ENTER.** This runs a batch file that restores all the supplied simulate programs to their original condition.

3. Type **`hptools`** and then press **ENTER** to re-start the Toolkit.

Mass Store Functions

Mass Store lets you perform various disk functions. To enter the Mass Store screen, press **F2** (Mass Store) from the Toolkit Main Group screen. Figure 7-3 shows the Mass Store screen.

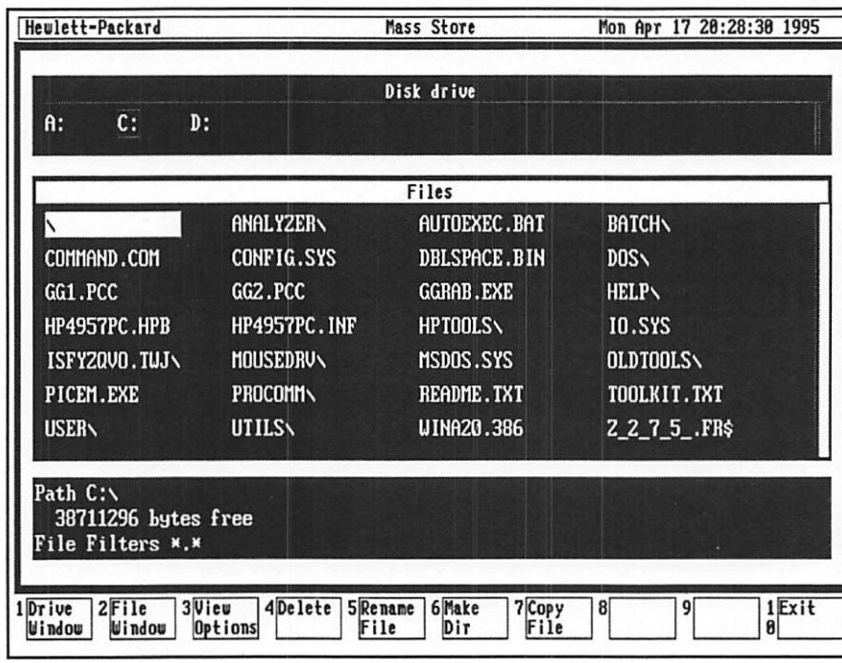


Figure 7-3: Mass Store Screen

The Mass Store screen is divided into two windows.

- The top window is labeled Disk Drive and displays the disk drives on your Internet Advisor.
- The bottom window is labeled Files and displays the files and directories in the disk drive that is highlighted.

The softkeys in the Mass Store screen provide the following functions:

F1 (Drive Window) Lets you access the Disk Drive window where you can select the disk drive you want displayed.

F2 (File Window) Lets you access the File window where you can select a directory or file. Use the arrow keys to move around the File window. If you select a directory, press **ENTER** to see the files in that directory.

F3 (View Options) Lets you set up how you want to view files and directories. The fields in the View Options Menu are:

Short Display If you select Yes in the **Short Display** field, just the name of the files and directories are shown in the Files window. If you select No in this field, files and directories are shown with the dates and times they were created and status information in the Files window.

File Filters This field lets you narrow the search for files and directories in the Files window. If you select the default (*.*), all files and directories in a particular disk drive are displayed. If, for example, you are looking for only application files, you could enter *.app in this field to display only files with an app extension.

Show Hidden/ System Files This field lets you display files that may not normally show up in regular file listings.

F4 (Delete) This lets you delete files and directories. Highlight the file or directory you want to delete, and then press **F4**. A confirmation window is displayed where you can cancel or complete the delete function.

F5 (Rename File) Lets you change the name of a file. Highlight the file you want to change and press **F5**. The Rename File Menu is displayed where you can type in the old and the new file names, or you can press **ENTER** to browse the current disk directories. Press **F10** (OK) to rename the file or **F1** (Cancel) to cancel the operation.

F6 (Make Dir) Lets you create new directories. When you press **F6**, the Make Directory Menu opens in which you can type in the new directory name. Press **F10** (OK) to create the directory or **F1** (Cancel) to cancel the operation.

F7 (Copy File) Lets you copy one file to another. Highlight the file you want to copy and press **F7**. The Copy Menu displays the name of the file you want to copy in the **Source File** field. Type the path and name of the destination file into the **Dest File** field, or press **ENTER** to browse the current disk directories. Press **F10** (OK) to copy the file or **F1** (Cancel) to cancel the operation.

F10 (Exit) Lets you exit the Mass Store screen.

Configuring a Printer

To configure the Internet Advisor to print to a printer, use the following procedure. Figure 7- 4 shows the Printer Setup Menu configured to print to a graphics mode printer connected to a parallel port (LPT1).

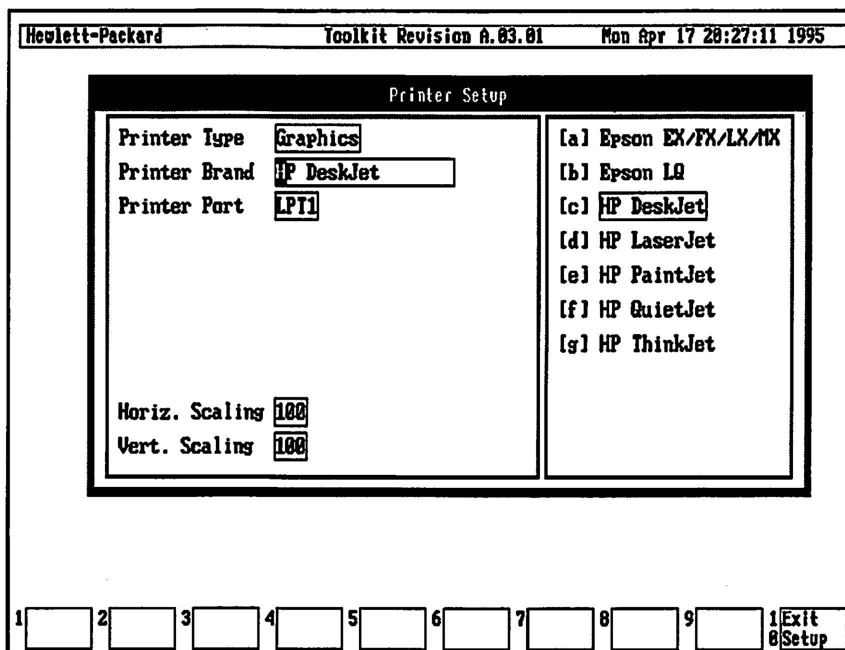


Figure 7-4: Printer Setup Menu

1. From the Internet Advisor's Main Group screen, press **F3** (Printer Setup). This opens the Printer Setup Menu.

2. Use the Up and Down arrow keys to move between the Printer Setup Menu fields and make selections for the following fields:

a. **Printer Type** - Select Graphics. All printouts from the High Speed Internet Advisor use graphics-mode printing, not ASCII. (The Low Speed Internet Advisor can use ASCII printing.) Select PC Decodes, from the Main Group screen, to print high speed data to an ASCII printer.

b. **Printer Brand** - Select the type of printer to which you will be printing.

c. **Printer Port** - Select the port to which the printer is connected: the serial port (COM1) or one of the parallel ports (LPT1, LPT2, or LPT3).

d. **Baud Rate** - If you selected COM1 for the **Printer Port** field, select the baud rate of your printer.

e. **Word Size** - If you selected COM1 for the **Printer Port** field, enter the number of bits per word (either 7 or 8) for your printer.

f. **Parity** - If you selected COM1 for the **Printer Port** field, select a parity (odd, even, or none).

g. **Stop bits** - If you selected COM1 for the **Printer Port** field, enter 1 or 2 for the number of stop bits.

h. **Horizontal Scaling** - If you selected Graphics for the **Printer Type** field, select a horizontal scaling. If the default setting of 100 produces a printout that is either too wide or too narrow, change this field to a number between 75 and 110. A smaller number reduces the width of the printout; a larger number increases the width.

i. **Vertical Scaling** - If you selected Graphics for the **Printer Type** field, select a vertical scaling. If the default setting of 100 produces a printout that is either too long or too short, change this field to a number between 75 and 110. A smaller number reduces the length of the printout; a larger number increases the length.

Configuring a Slave for Remote Operation

You can set up the Internet Advisor for remote operations in the Slave Setup Menu, shown in Figure 7-5. Refer to the following "PCMCIA Modem Setup" section if you are going to use a PCMCIA modem for remote control of the Internet Advisor.

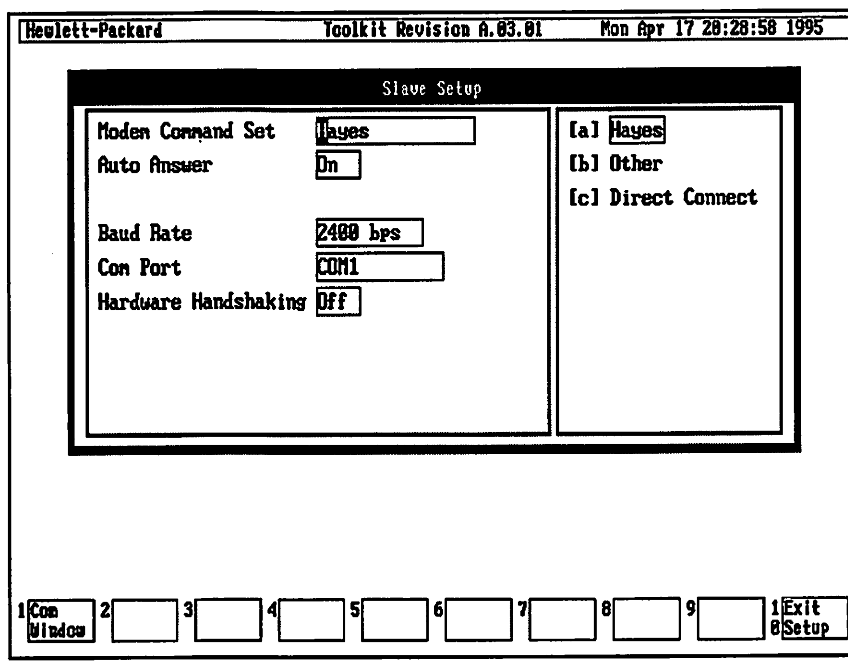


Figure 7-5: Slave Setup Menu

To configure a slave, use the following procedure:

1. From the Toolkit Main Group screen, press **F4** (Slave Setup). The Slave Setup menu is displayed.

2. Use the Up and Down arrow keys to move between the Slave Setup Menu fields and make selections for the following fields:

   a. **Modem Command Set** - Select Hayes, Other, or Direct Connect. If you select Hayes, another field, **Auto Answer**, appears. The **F1** (Com Window) key lets you open a terminal emulator window where you can manually configure either the Hayes or Other modems.

   b. **Auto Answer** - If you select Hayes for the **Modem Command Set** field, you can choose On or Off for this field. If you select On, your modem is automatically configured for Auto Answer the next time you turn on the Internet Advisor, and, more importantly, the Internet Advisor automatically answers a call from the master unit.

   c. **Baud Rate** - Select a baud rate from the available choices. If performance degrades above 9600 bps, try lowering the baud rate.

   d. **Com Port** - The choices for this field are COM1, Internal Modem (COM2), COM3, and Other. If you select COM3, a new field appears: **IRQ (2-15)**. If you select Other, two new fields appear: **Com Base** and **IRQ (2-15)**.

   e. **Hardware Handshaking** - This field appears as long as the **Com Port** field is not set to Modem (COM2). The choices for this field are On and Off. On sets DTR and RTS on and then the Internet Advisor waits for DSR and CTS to go on before sending information. Off causes the Internet Advisor to ignore the state of the physical leads. This makes a remote recovery impossible because the remote unit will not be aware of a line failure reported by the modem. Therefore, the On setting is recommended.

   f. **Com Base** and **IRQ (2-15)** - If you select Other in the **Com Port** field, these fields appear to prompt you for the Base Address of the card and the Interrupt type code (IRQ). The most common Base addresses are 3F8h, 2F8h, 3E8h, and 2E8h with the common IRQ values being 3 and 4. These values are not standardized among serial card manufactures, and you will need to know what your card uses. You are allowed to input any base address you want but you must convert any hex address

to a decimal address before entering it. Also, it would be safe to enter the corresponding IRQ value as 3, 10, 12, or 15. IRQ 3 can only be used if you are not using the Internet Advisor's internal modem.

You may get unpredictable results if you use an incorrect IRQ value. If you use an IRQ that is incorrect, your Internet Advisor will most likely lock-up and a power cycle will be required.

NOTE

Be sure to consult the serial card's documentation before selecting the base address and IRQ values.

PCMCIA Modem Setup

You can use a PCMCIA modem (only available on some models of the Internet Advisor) for remote control of the Internet Advisor. To do so, you must configure the Internet Advisor to use COM port 4 and Interrupt (IRQ) 3. This is done in one of two places depending on whether your instrument will be the master controller or the slave. The Remote Configuration Menu, used for the master controller, is reached by selecting **Remote Control** from the Main Group screen. The Slave Setup Menu is reached by pressing **F4** (Slave Setup) from the Main Group screen. Changing one configuration automatically changes the other.

Configure the following information to use a PCMCIA modem for remote control of the Internet Advisor:

Com Port	Other
Hardware Handshaking	Off
Com Base	744 (This is the decimal equivalent of 2E8H for the COM 4 I/O address.)
IRQ	3

The other settings in the menu depend on the type of modem used. However, you should leave AutoAnswer On when modifying the slave setup. This allows the instrument to be remotely captured in an unattended setting.

Configuring the Internet Advisor's Sound

Using the System Setup Menu, you can control whether the Internet Advisor's sound is on or off. The System Setup Menu also shows you information about the operating system, the machine type, and the available memory. Figure 7-6 shows the System Setup Menu.

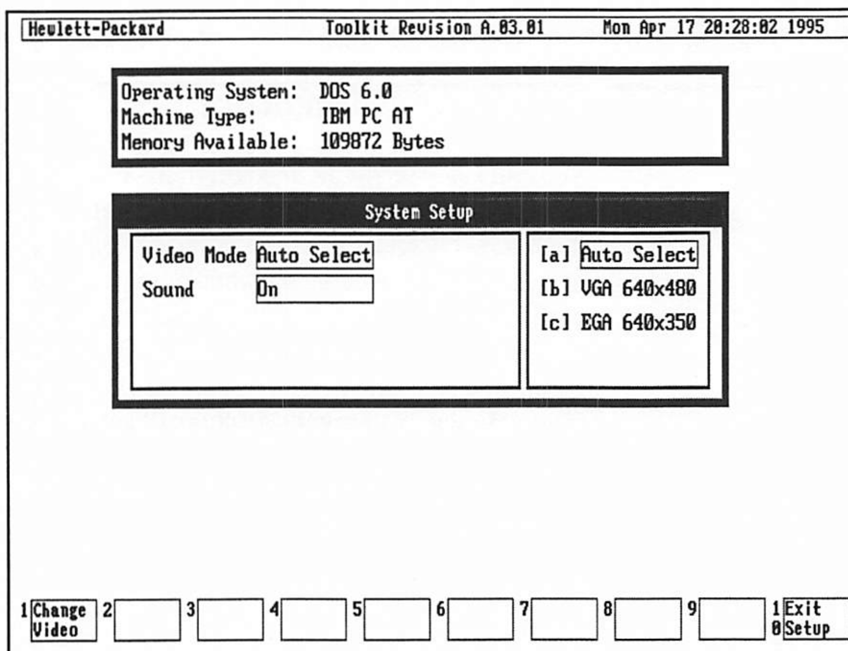


Figure 7-6: System Setup Menu

Use the following procedure to control whether sound (that is, the beep) is on or off:

1. From the Toolkit Main Group screen, press **F6** (System Setup).
2. Turn the sound on or off by making the appropriate selection in the **Sound** field.

A

Internet Advisor Features

RS-232/V.24 Breakout Box and System LEDs

The Internet Advisor gives you breakout box and jumpering capabilities for RS-232/V.24 circuits. Figure A-1 shows the breakout box and its associated connections. Note that the large black arrows point to the RS-232/V.24 test connectors on the side of the Advisor. The rearward connector is the preferred test input for most tests. The forward connector should only be used when signals need to be isolated by the rocker switches or cross-connected by way of the switch jacks and jumper leads.

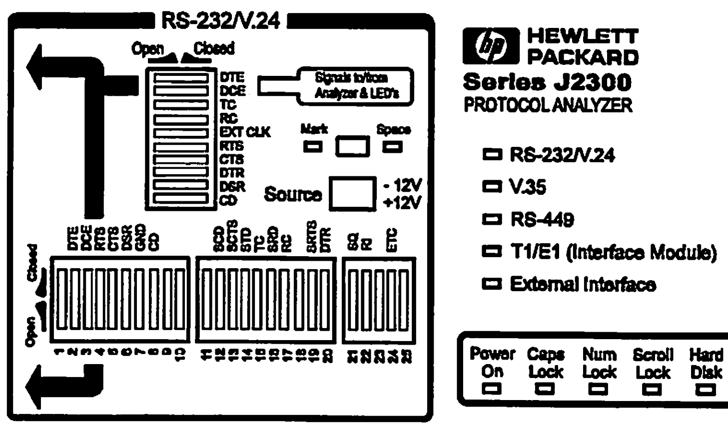


Figure A-1: RS-232/V.24 Breakout Box and System LEDs

All 25 leads are accessible for jumpering on either side of the breakout switches (the lateral switch bank numbered 1 through 25.) If you wish to monitor or simulate on auxiliary data channels or to observe control signals other than RTS, CTS, DTR, DSR and CD, you can perform the appropriate transpositions by opening the corresponding switches and jumpering between the appropriate leads.

To do so, connect the circuit under test to the Internet Advisor through the forward RS-232 test connector and perform the necessary transpositions over the lateral switch bank.

The vertical switch bank provides hardware isolation of incoming or outgoing data and control signals for special purpose testing. An example would be using the Internet Advisor to supply terminal generated control signals without conflicting with existing data signals. In this case it would be appropriate to open the DTE switch to isolate the circuit being tested from the internal data transmitter.

NOTE

Pin 1 of the rearward RS-232 test port is Frame Ground or Protective Ground, and it is connected to the case of the Internet Advisor and, through the third wire of the power cable, to Ground. If you have a data circuit which requires isolation of Frame Ground, use the forward RS-232 test port and open switch 1 on the lateral switch bank.

Pin 7 of the rearward RS-232 test port is Signal Ground, and it is isolated from Frame Ground by 100 KOhms to minimize ground-loop problems.

In monitor mode, the inputs to all V-Series signal receivers represent only 1/5 of a standard load. This is to minimize circuit loading effects. When you use the Internet Advisor for Simulating and BERT testing, the transmitters are configured with normal source impedance.

Mark/Space Indicator

You can use the Mark/Space Indicator to test the state of any circuit on an RS-232/V.24 interface. The Mark/Space Indicator has two test jacks which are connected together electrically. To do this, simply jumper from any test jack on either of the lateral or vertical switch banks to either of the Mark/Space Indicator jacks and observe the results. If the incoming signal is more positive than +3.0 volts the Space LED lights. If the incoming signal is more negative than -3.0 volts the Mark LED lights. If both the Mark and the Space LEDs light, then the incoming signal is actively changing states. This is normal for data and clock signals but indicates a problem for control signals.

NOTE

EIA-232D (Formerly RS-232C) specifications consider interface signals in the range of -3.0 to +3.0 volts to be indeterminate (or not valid) Consistent with this recommendation, the Mark/Space Indicator treats signals in this range as "not present" and gives no indication.

Source Voltage

You can hard-wire any signal or control line as On or Off by jumpering it to the Source jacks. The rearward three jacks are connected together electrically and supply -12 volts through a 1 KOhm resistor. The forward three jacks are connected together electrically and supply +12 volts through a 1 KOhm resistor. If you connect a signal or control line to the -12 volts supply it creates a Mark or Off state and if you connect it to the +12 volts supply it creates a Space or On state.

Active Interface LEDs

The following is a list of the five LEDs that indicate which interface is currently configured:

- RS-232/V.24
- V.35
- RS-449
- T1/E1
- External Interface

CAUTION

Do not connect more than one Internet Advisor port at a time. The V.35, RS-449, RS-232, and External ports are not independent of one another. Connecting more than one port at a time can cause unreliable results from the Internet Advisor.

Lead Status LEDs

On the right side, rearward of the keyboard, are ten pairs of LEDs that provide a real-time indication of lead status for all of the interfaces. These LEDs also indicate data, clock and control information for the V-Series interfaces. The following list provides information on the meaning of the lighted LEDs:

Left column, Red	Mark State for Data, Off State for Control Signals.
Right column, Green	Space State for Data, On State for Control Signals.
Both LEDs lighted	Active signal toggling.
Neither LED lighted	No signal present.

When the selected interface is RS-232/V.24, the left column LEDs light when the signal level is more negative than -3.6 volts and the right column LEDs light when the signal level is more positive than +3.6 volts. This is a safety margin of 20% above EIA-232D minimum signal requirements of -3.0 and -3.6 volts. If the circuit under test is lighting the proper Internet Advisor LEDs, then there is enough signal present to allow any EIA-232D/RS-232 conforming device to receive the data and control signals. If the circuit under test cannot light these LEDs, the signal levels are too low for reliable reception.

For the T1 and E1 interfaces, the left column shows the state of the Equipment (or user) signal and the right column shows the state of the Line (or central office) signal. Alarm and Error indications cause their respective red LEDs to light. The green Signal LEDs light if a signal is present. If there is no signal present, the topmost red LED lights to indicate a loss of signal.

These LEDs can provide a visual indication as to whether a V-Series device is physically DTE or DCE. First connect the Internet Advisor to the device under test and configure it for the Monitor mode. If either the DTE/SD Mark or Space LED lights, the device under test is DTE. If the DCE/RD Mark or Space LED lights, the device under test is DCE. If the Internet Advisor is to Simulate a device under test, it must complement the device's physical characteristic. If the device is DTE, the Internet Advisor must be DCE and vice versa.

B

Supplied Tests

The High Speed Internet Advisor comes with a number of preconfigured, factory-supplied tests which generally are preconfigured in the following ways:

- The Internet Advisor's user-definable hardware counters are preconfigured to provide very specific information such as frame counts and packet counts. Refer to the section "Filters and Counters" in chapter 3, "Configuring the Internet Advisor," for information on filters and counters.

- The Interface Setup Menu is preconfigured appropriately. For example, the **Interface Type** field is set to V.35 and the **Run Mode** field is set to Monitor in the preconfigured X.25 Packet Counts/V.35 Monitor test. Refer to the section "Configuring Interfaces" in chapter 3, "Configuring the Internet Advisor," for information on the Interface Setup Menu.

- The Decode Configuration Menu is preconfigured so that appropriate information is shown in the Decode display. For example, in the preconfigured X.25 Monitor tests, the Decode Configuration is preconfigured to display X.25 level 2 data, X.25 level 3 data, and user data. Refer to chapter 4, "Monitoring," for information on Decode Configuration.

- The Run Configuration Menu is preconfigured to provide LCN or DLCI (Data Link Connection Identifier) statistics (as appropriate) and the run period, which controls how long the test runs, is preconfigured to be continuous. Refer to the section "Run Configuration" in chapter 3, "Configuring the Internet Advisor," for more information.

The Internet Advisor also comes with a number of "generic" tests. In the generic tests, the filters and counters are not preconfigured, but the Decode Configuration Menu and the Run Configuration Menu are preconfigured. By defining filters and counters and by configuring the Interface Setup Menu, you determine what information these tests provide.

You can modify the preconfigured or the generic tests or you can use them as they are according to your particular needs. If you frequently need to modify either a preconfigured or a generic test before you use it, you can make your modifications and then save your configuration. Then you can add your configuration as a new test to the Toolkit. If you do this, you won't need to modify the supplied test every time you want to run your test. Refer to the section "Adding a Test of Your Own to the Toolkit" in chapter 7, "The Toolkit User Interface," for more information.

Overview of Supplied Tests

The High Speed Internet Advisor's preconfigured and generic tests can be accessed from the Main Group\High Speed Analyzr screen, shown in Figure B-1.

To access the Main Group\High Speed Analyzr screen, highlight **High Speed Analyzr** in the Main Group screen and press **ENTER**.

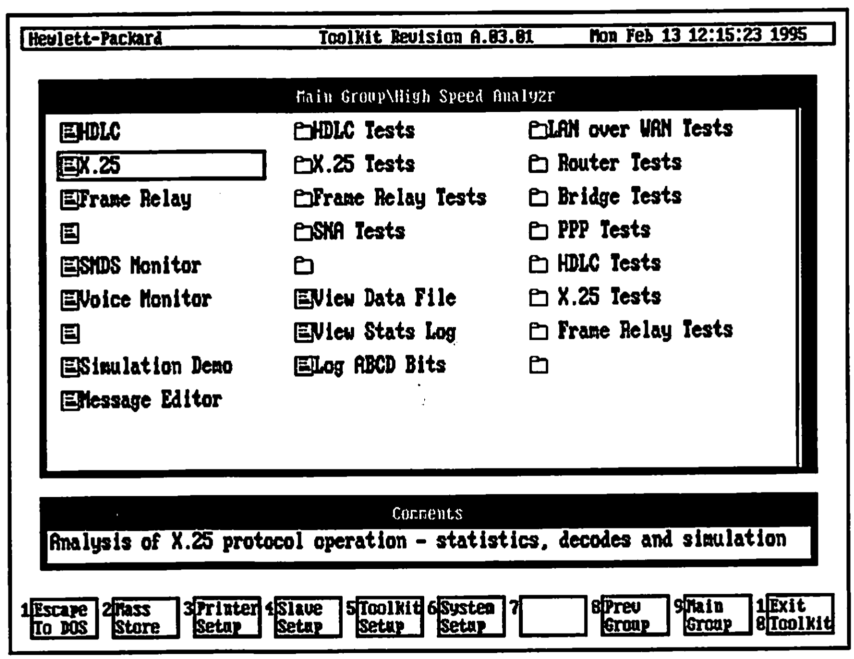


Figure B-1: Main Group\High Speed Analyzr Screen

In the Main Group\High Speed Analyzr screen, as in the Main Group screen and other Toolkit screens, tests are labeled with page icons ( ) or file-folder icons ( ). Generally, page icons access a single tool or test, while file-folder icons access groups of tests. Refer to chapter 7, "The Toolkit User Interface," for more information on Toolkit.

The page icons and the file-folder icons in the Main Group\High Speed Analyzr screen can be categorized into these groups:

- The page icons () in the top half of the left-most column (**HDLC, X.25,** and **Frame Relay**) each provide access to a generic test that provides statistics, decodes, and simulation capability for a specific protocol. The filters and counters in these tests are not preconfigured, nor is the Interface Setup Menu. Therefore, you must configure these tests to match the protocols on the network you are going to test. Each of these generic tests is described in a separate section in this chapter that deals with tests for a specific protocol. For example, the generic HDLC test is described in "Generic HDLC Test" under the "Tests for HDLC" section.

- The file-folder icons () in the top half of the middle column (**HDLC Tests, X.25 Tests, Frame Relay Tests,** and **SNA Tests**) each provide access to a group of preconfigured tests for a specific protocol. These tests are very specific because the user-definable counters are preconfigured to gather unique statistics. Each of these groups of tests is described in a separate section in this chapter that deals with tests for a specific protocol. For example, the preconfigured HDLC tests are described in "Preconfigured HDLC Tests" under the "Tests for HDLC" section.

- The page icons () in the bottom half of the left-most column (**SMDS Monitor, Voice Monitor, Simulation Demo,** and **Message Editor**) and the page icons in the bottom half of the middle column (**View Data File, View Stats Log,** and **Log ABCD Bits**) each provide access to a unique program or test. Each of these tests is described in a separate section in this chapter.

- The file-folder icons () in the right-most column under **LAN over WAN Tests** provide access to groups of tests that are concerned with LAN traffic on WAN links. In these tests, the user-definable counters are preconfigured to provide protocol- and vendor-specific counts. These preconfigured tests are described in the section "LAN Over WAN Tests."

HDLC Tests

The **HDLC** page icon () accesses a generic test that provides statistics, decodes, and simulation capability for the HDLC protocol. The filters and counters in this test are not preconfigured, and neither is the Interface Setup Menu. Therefore, you must configure this test to match the network you are going to test. Refer to the section "Generic HDLC Test" for more information on this test.

The **HDLC Tests** file-folder icon () provides access to a group of monitor and simulation tests for the HDLC protocol. These tests are very specific because the user-definable hardware counters are preconfigured to gather unique statistics. Refer to the section "Preconfigured HDLC Tests" for more information on these tests.

Generic HDLC Test

To use the generic HDLC test, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **HDLC** page icon and press **ENTER**. The Interface Setup Menu is displayed.

2. Set the **Interface Type** field and the other fields in the Interface Setup Menu to match the network you are going to test. Refer to chapter 3, "Configuring the Internet Advisor," for more information on using the Interface Setup Menu.

3. To view the decoded data, press **F6** (Decode Frames). Refer to chapter 4, "Monitoring," for more information on decodes.

4. To view link level statistics, T1 statistics (if the **Interface Type** field is configured for T1), and E1 statistics (if the **Interface Type** field is configured for E1), press **F7** (Stats & Countrs) from the Interface Setup Menu or from the Decode display. Refer to chapter 4, "Monitoring," for more information on statistics.

Table B-1: Link Level Statistics

Link Level Statistics	If Configured for T1	If Configured for E1
Link Level Counts: Total Octets Data Segments Total Frames Bad FCS Abort Frames **Link Level Utilization (%):** Maximum Instantaneous Minimum **Link Level Throughput (kbps):** Maximum Instantaneous Minimum Average	BPV Frame Bit Error Frame Slip ESF CRC Error (if configured for ESF)	Code Violation FAS Error CRC-4 Error (if configured for CRC-4)

5. To view the current line status (if the **Interface Type** field is configured for T1 or E1), press **F8** (Line Status) from the Statistics and Counters screen.

Table B-2: Current Line Status

If Configured for T1	If Configured for T1 and ESF	If Configured for E1
Signal Present Signal Loss Frame Sync Frame Loss Frame Slip B8ZS (if configured for B8ZS) BPV AIS/All 1's Ones Density Excess Zeroes (if configured for B8ZS) Yellow Alarm ESF CRC Errors (if configured for ESF)	CRC Error Event Severe Framing Error Frame Sync Bit Error Line Code Error Slip Error Payload Loop Back	Signal Present Signal Loss Frame Sync Frame Loss FA Error HDB3 (if configured for HD3B) Line Code Violation AIS/All 1's Remote Alarm CRC-4 Errors (if configured for CRC-4)

6. To view history line status information (if the **Interface Type** field is configured for T1 or E1), press **F8** (Line History) or **PgDn** from the Line Status (Page 1 of 3) screen.

Table B-3: History Line Status

If Configured for T1	If Configured for E1
Signal Present Signal Loss Frame Sync Frame Loss Frame Slip B8ZS (if configured for B8ZS) BPV AIS/All 1's Ones Density Excess Zeroes (if configured for B8ZS) Yellow Alarm ESF CRC Errors (if configured for ESF)	Signal Present Signal Loss Frame Sync Frame Loss FA Error HDB3 (if configured for HD3B) Line Code Violation AIS/All 1's Remote Alarm CRC-4 Errors (if configured for CRC-4)

7. To view the ABCD signalling bits (if the **Interface Type** field is configured for T1, the **Data Channel** field is set to Fractional or Full Frame 56 kbps, and the **Framing Type** field is set to ESF), press **F8** (ABCD Bits) or **PgDn** from the Line Status (Page 2 of 3) screen. To view the AB signalling bits (if the **Interface Type** field is configured for T1, the **Data Channel** field is set to Fractional or Full Frame 56 kbps, and the **Framing Type** field is set to D4), press **F8** (AB Bits) or **PgDn** from the Line Status (Page 2 of 3) screen.

Table B-4: Signalling Bits

If Configured for T1, 56 kbps, and ESF	If Configured for T1, 56 kbps, and D4
Channel 01 to 24 Eqpt and Line ABCD Bits	Channel 01 to 24 Eqpt and Line AB Bits

Preconfigured HDLC Tests

To use the preconfigured HDLC tests, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **HDLC Tests** file-folder icon and press **ENTER**.

The Main Group\High Speed Analyzr\HDLC Tests screen is displayed showing three groups of tests: **Monitor Tests, Simulate DTE/Eqpt,** and **Simulate DCE/Line.**

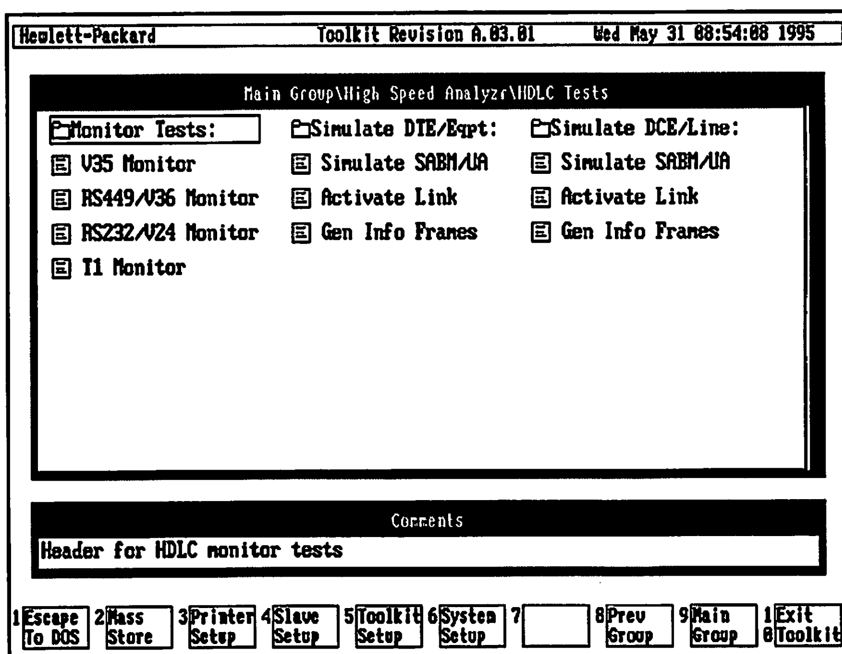


Figure B-2: Preconfigured HDLC Tests

2. Highlight a test under one of these three groups, and press **ENTER** to start the test.

Preconfigured HDLC Monitor Tests

The purpose of these tests is to monitor the network under test and to provide counts of specific types of traffic on the network under test. Therefore, the counters are preconfigured to provide frame counts for the link level protocol, and the **Interface Type** field in the Interface Setup Menu is set to Monitor. You can get the same type of decode information, link level statistics, current and history line status information, and signalling bits information that you can get in the generic HDLC test (refer to Table B-1).

NOTE

There are slight differences in nomenclature between the T1 and the E1 software systems. In the T1 systems, there are page icons for RS232/V24 and RS449/V36. In the E1 systems these tests are labeled V24 and V36 respectively. The following descriptions of these tests use the E1 labels for brevity.

The following HDLC monitor tests are available:

- **V35 Monitor**
- **V36 Monitor**
- **V24 Monitor**
- **T1 Monitor** or **CEPT E1 Monitor**

The V35, V36, and V24 monitor tests provide identical information on layer 2 statistics and decodes. Their only difference is the configuration of the interface.

All the V-Series monitor tests begin collecting data as soon as they are selected. If you need to change any interface setup parameters, press **F10** (Exit To Setup), make the necessary changes in the Interface Setup Menu, and then press **F7** (Stats & Countrs) to restart the test.

The **T1 Monitor** and the **CEPT E1 Monitor** tests display the Interface Setup Menu first so you can configure the interface before proceeding.

To see all frames completely decoded, press **F6** (Decode Frames). Refer to chapter 4, "Monitoring," for more information on decodes.

To view the frame count information the preconfigured counters provide, press **PgDn** or Down Arrow from the Statistics and Counters (Page 1 of 2) screen:

Table B-5: Counters in Preconfigured HDLC Monitor Tests

Link Protocol Frame Counts
Bad Frames
Abort Frames
INFO Frames
Non-I Frames
Supervisory
_RR (Receiver Ready)
_RNR (Receiver Not Ready)
_Reject
Unnumbered
_SABM (Set Asynchronous Balanced Mode)
_SNRM (Set Normal Response Mode)
_UA (Unnumbered Acknowledgment)
_DISC (Disconnect)
_FRMR (Frame Reject)
_DM (Disconnect Mode)
_UI (Unnumbered Information)

Preconfigured HDLC Simulation Tests

These tests generate traffic and provide counts of specific types of traffic on the link under test. Therefore, the counters are predefined to provide frame counts for the link level protocol, just as they are in the preconfigured HDLC monitor tests (see Table B-5). You can also get the same type of decode information, link level statistics, line status information, and signalling bits information available in the generic HDLC test (see Tables B-1 through B-4). There are three pairs of simulation programs. One program of each pair simulates DTE/Eqpt and the other simulates DCE/Line.

- In the first pair of tests, **Simulate SABM/UA**, the Internet Advisor repeatedly transmits SABM frames, waiting 250 milliseconds between transmissions.
- The second pair of tests, **Activate Link**, allow for SABM, Information, and DISC frames to be sent in response to the user pressing softkeys. The various responses from the device under test are presented as messages on the screen and can also be seen in the Decode displays.
- The third pair of tests, **Gen Info Frames**, repeatedly send INFO frames with the "Fox" message.

X.25 Tests

The **X.25** page icon (▤) accesses a generic test that provides statistics, decodes, and simulation capability for the X.25 protocol. The filters and counters in this test are not preconfigured, and neither is the Interface Setup Menu. Therefore, you must configure this test to match the network you are going to test. Refer to the section "Generic X.25 Test" for more information on this test.

The **X.25 Tests** file-folder icon (🗀) provides access to a group of monitor and simulation tests for the X.25 protocol. These tests are very specific because the user-definable hardware counters are preconfigured to gather unique statistics. Refer to the section "Preconfigured X.25 Tests" for more information on these tests.

Generic X.25 Test

To use the generic X.25 test, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **X.25** page icon and press **ENTER**. The Interface Setup Menu opens.

2. Set the **Interface Type** field and the other fields in the Interface Setup Menu to match the network you are going to test. Refer to chapter 3, "Configuring the Internet Advisor," for more information on using the Interface Setup Menu.

Once you have configured the Interface Setup Menu, you can do such things as define filters and counters (refer to chapter 3, "Configuring the Internet Advisor") and decode X.25 data (refer to chapter 4, "Monitoring"). You can also look at link level statistics, line status information (as long as the **Interface Type** field is set to T1 or E1), and signalling bit information (as long as the **Interface Type** field is set to T1). Refer to Tables B-1 through B-4 in the "Generic HDLC Test" section for more information on viewing link level statistics, line status information, and signalling bits information.

3. To view X.25 LCN statistics, press **F7** (LCN Stats) from the Statistics and Counters screen:

Table B-6: LCN Statistics Available in the Generic X.25 Test

LCN Statistics
Number of Active LCN
X.25 Counts:
X.25 Octets
Total Packets
Pkts/Sec
Abort Packets
X.25 Utilization (%):
Maximum
Instantaneous
Minimum
X.25 Throughput (kbps):
Maximum
Instantaneous
Minimum
Average

4. To view LCN statistics for the next LCN, press **F3** (Next LCN). To view LCN statistics for the previous LCN, press **F3** (Previous LCN).

Preconfigured X.25 Tests

To use the preconfigured X.25 tests, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **X.25 Tests** file-folder icon and press **ENTER**.

   The Main Group\High Speed Analyzr\X.25 Tests screen is displayed showing three groups of tests: **Monitor Tests, Simulate DTE/Eqpt**, and **Simulate DCE/Line.**

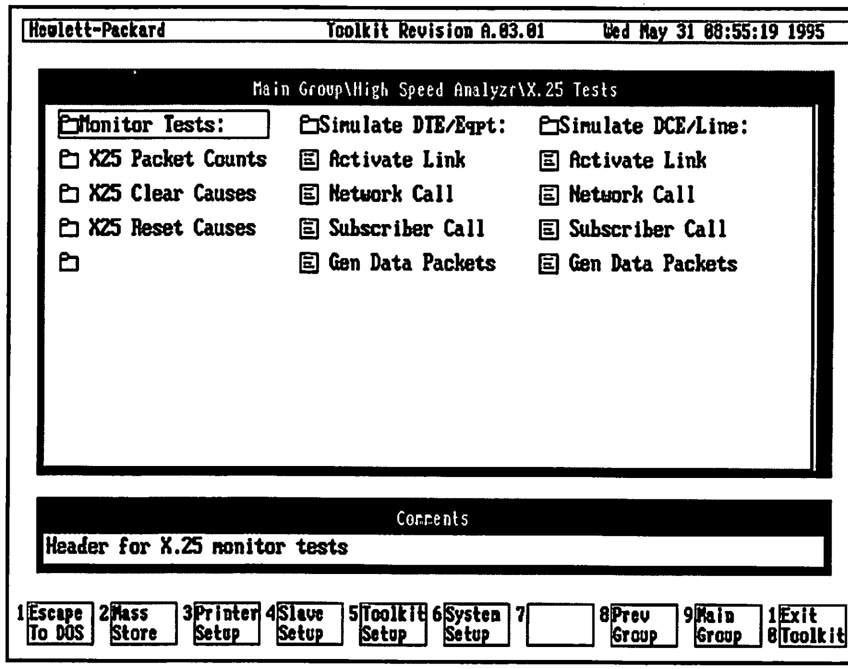


Figure B-3: Preconfigured X.25 Tests

2. Highlight a test in one of these three groups and press **ENTER**. If you select one of the simulation tests, the test is started. If you select one of the monitor tests, another screen is displayed in which you can select from four interface-specific monitor tests.

Preconfigured X.25 Monitor Tests

The purpose of these tests is to monitor the network under test and to provide counts of specific types of traffic on the network under test. Therefore, the counters are preconfigured and the **Interface Type** field in the Interface Setup Menu is set to Monitor.

NOTE

There are slight differences in nomenclature between the T1 and the E1 software systems. In the T1 systems, there are page icons for RS232/V24 and RS449/V36. In the E1 systems these tests are labeled V24 and V36 respectively. The following descriptions of these tests use the E1 labels for brevity.

There are three groups of X.25 preconfigured monitor tests:

- **X25 Packet Counts**
- **X25 Clear Causes**
- **X25 Reset Causes**

Each of these groups contains four interface-specific monitor tests:

- **V35 Monitor**
- **V36 Monitor**
- **V24 Monitor**
- **T1 Monitor** or **CEPT E1 Monitor**

Within a monitor group, all the V35, V36, and V24 Monitor tests provide identical measurements. Their only difference is the configuration of the interface.

All the V-Series monitor tests begin collecting data as soon as they are selected. If you need to change any interface setup parameters, press **F10** (Exit To Setup), make the necessary changes in the Interface Setup Menu, and then press **F7** (Stats & Countrs) to restart the test.

The **T1 Monitor** and the **CEPT E1 Monitor** tests display the Interface Setup Menu first so you can configure the interface before proceeding.

All four of the X.25 Packet Counts tests, the X.25 Clear Causes tests, and the X.25 Reset Causes tests provide decode information, link level statistics, current and history line status information, and LCN statistics similar to the generic X.25 test. They provide additional information through the preconfigured counters. The four X.25 Packet Counts tests provide packet count information. The four X.25 Clear Causes tests provide statistics regarding X.25 call clearing, and the four X.25 Reset Causes tests provide counts of the reasons for X.25 protocol resets.

To see all frames completely decoded, press **F6** (Decode Frames). Refer to chapter 4, "Monitoring," for more information on decodes.

To view the information the counters provide, press **PgDn** or Down Arrow from the Statistics and Counters (Page 1 of 2) screen:

Table B-7: Counters in Preconfigured X.25 Monitor Tests

X.25 Packets Tests	X.25 Clear Causes Tests	X.25 Reset Causes Tests
DATA packet	DTE Origin	RESET Cause
CALL request	Net Congestion	Net Congestion
CALL accept	Number Busy	Rem Proc Error
CLEAR request	Out of Order	Loc Proc Error
CLEAR confirmation	Rem Proc Error	Incompatible
RESTART request	Rev charge Error	Rem DTE operation
RESTART confirmation	Incompatible	Net Operational
RESET request	Fast Select Error	Out of Order
RESET confirmation	Ship Absent	Net Out Order
INTERRUPT	Invalid Facility	DTE origin
INTERRUPT confirmation	Access Barred	
DIAGNOSTIC	Loc Proc Error	
REGISTRATION	Not Obtainable	
REJECT modulo 8	RPOA Out Order	
RNR modulo 8 (Receiver Not Ready)	Clear Packet	
SABM (Set Asynchronous Balanced Mode)		

Preconfigured X.25 Simulation Tests

The purpose of these tests is to generate traffic and to provide counts of specific types of traffic on the link under test. Therefore, the hardware counters are predefined in these tests to provide X.25 packet counts, just as they are in the X.25 Packets Counts monitor tests (refer to Table B-7). In addition, you can get the same type of decode information, link level statistics, current and history line status information, and signalling bits information that you get in the generic HDLC test (refer to Tables B-1 through B-4), and the LCN statistics that you get in the generic X.25 test (refer to Table B-6).

There are four pairs of simulation programs. One program of each pair simulates DTE/Eqpt and the other simulates DCE/Line.

- The first pair of tests, **Activate Link**, lets you initialize the link layer by sending SABM, Information, and DISC frames in response to pressing softkeys. The various responses from the device under test are presented as messages on the screen and can also be seen in the decode displays. Level 2 emulation is on in this test.
- The second pair of tests, **Network Call**, simulate a network placing a call to a user on LCN 1.
- The third pair of tests, **Subscriber Call**, simulate a user placing a call into the network on LCN 1.

NOTE

Normally Subscriber Calls are associated with DTE/Eqpt and Network Calls are associated with DCE/Line. If the testing is done on the interior of the network, however, the Subscriber may appear physically as DCE/Line and the network as DTE/Eqpt. This is why there are two versions of the Network Call and Subscriber Call simulations.

NOTE

Refer to the section “X.25 Subscriber Call and Network Call Tests” in chapter 5, “Simulating,” for information on how to modify the LCN or calling numbers in these simulation programs. A similar process can be used to change the LCN in the General Data Packets program as well.

- The final pair of tests, **Gen Data Packets,** sends a packet on LCN 20. The data is the “Fox” message repeated once every 500 milliseconds.

Frame Relay Tests

The **Frame Relay** page icon (▤) accesses a generic test that provides statistics, decodes, and simulation capability for the Frame Relay protocol. The filters and counters in this test are not preconfigured, and neither is the Interface Setup Menu. Therefore, you must configure this test to match the network you are going to test. Refer to the section "Generic Frame Relay Test" for more information on this test.

The **Frame Relay Tests** file-folder icon (🗀) provides access to a group of tests for the Frame Relay protocol. These tests are very specific because the user-definable hardware counters are preconfigured to gather unique statistics. Refer to the section "Preconfigured Frame Relay Tests" for more information on these tests.

Generic Frame Relay Test

To use the generic Frame Relay test, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **Frame Relay** page icon and press **ENTER**. The Interface Setup Menu opens.

2. Set the **Interface Type** field and the other fields in the Interface Setup Menu to match the network you are going to test. Refer to chapter 3, "Configuring the Internet Advisor," for more information on using the Interface Setup Menu.

Once you have configured the Interface Setup Menu, you can do such things as define filters and counters (refer to chapter 3, "Configuring the Internet Advisor") and decode Frame Relay data (refer to chapter 4, "Monitoring"). You can also look at link level statistics, line status information (as long as the **Interface Type** field is set to T1 or E1), and signalling bit information (as long as the **Interface Type** field is set to T1). Refer to Tables B-1 through B-4 in the "Generic HDLC Test" section for more information on viewing link level statistics, line status information, and signalling bits information.

NOTE

For the generic Frame Relay test, link level statistics are the same as those shown in Table B-1 except there is an additional statistic, Short Frames.

3. To view DLCI (Data Link Connection Identifier) statistics, press **F7** (DLCI Stats) from the Statistics and Counters screen:

Table B-8: DLCI Statistics Available in the Generic Frame Relay Test

DLCI Statistics
Number of Active DLCI
DLCI Counts:
User Octets
Total Frames
Abort Frames
Short Frames
DE (Discard Eligibility)
FECN (Forward Explicit Congestion Notification)
BECN (Backward Explicit Congestion Notification)
DLCI Utilization (%):
Maximum
Instantaneous
Minimum
DLCI Throughput (kbps):
Maximum
Instantaneous
Minimum
Average

4. To view DLCI statistics for the next DLCI, press **F3** (Next DLCI). To view DLCI statistics for the previous DLCI, press **F4** (Prev DLCI).

Preconfigured Frame Relay Tests

To use the preconfigured Frame Relay tests, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **Frame Relay Tests** file-folder icon and press **ENTER**.

   The Main Group\High Speed Analyzr\Frame Relay Tests screen opens showing three groups of tests: **Monitor Tests, Simulate DTE/Eqpt**, and **Simulate DCE/Line**.

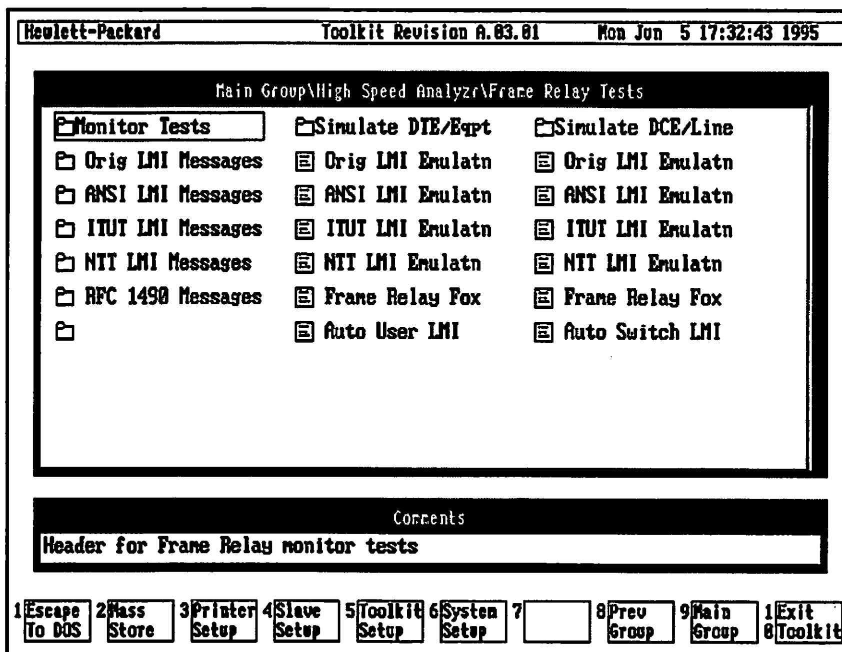


Figure B-4: Preconfigured Frame Relay Tests

2. Highlight a test in one of these three groups and press **ENTER**. If you select one of the simulation tests, the test is started. If you select one of the monitor tests, another screen opens in which you can select from four interface-specific monitor tests.

Preconfigured Frame Relay Monitor Tests

The purpose of these tests is to monitor the network under test and to provide counts of specific types of traffic on the network under test. Therefore, the counters are preconfigured and the **Interface Type** field in the Interface Setup Menu is set to Monitor.

NOTE

There are slight differences in nomenclature between the T1 and the E1 software systems. In the T1 systems, there are page icons for RS232/V24 and RS449/V36. In the E1 systems these tests are labeled V24 and V36 respectively. The following descriptions of these tests use the E1 labels for brevity.

There are five groups of Frame Relay preconfigured monitor tests:

- **Orig LMI Messages**
- **ANSI LMI Messages**
- **ITUT LMI Messages**
- **NTT LMI Messages**
- **RFC 1490 Messages**

Each of these groups contains four interface-specific monitor tests:

- **V35 Monitor**
- **V36 Monitor**
- **V24 Monitor**
- **T1 Monitor** or **CEPT E1 Monitor**

Within a monitor group, all the V35, V36, and V24 Monitor tests provide identical measurements. Their only difference is the configuration of the interface.

All the V-Series monitor tests begin collecting data as soon as they are selected. If you need to change any interface setup parameters, press **F10** (Exit To Setup), make the necessary changes in the Interface Setup Menu, and then press **F7** (Stats & Countrs) to restart the test.

The **T1 Monitor** and the **CEPT E1 Monitor** tests display the Interface Setup Menu first so you can configure the interface before proceeding.

All the tests in all five of the monitor groups provide decode information, link level statistics, and current and history line status information similar to the HDLC generic test (refer to Tables B-1 through B-4), and DLCI statistics similar to the generic Frame Relay test (refer to Table B-8). In addition, they provide special information through the preconfigured counters.

NOTE

For the preconfigured Frame Relay monitor tests, link level statistics are the same as those shown in Table B-1 except there is an additional statistic, Short Frames.

To see all frames completely decoded, press **F6** (Decode Frames). Refer to chapter 4, "Monitoring," for more information on decodes.

To view the information the counters provide, press **PgDn** or Down Arrow from the Statistics and Counters (Page 1 of 2) screen:

Table B-9: Counters in Preconfigured Frame Relay Monitor Tests

Orig LMI or ANSI LMI Messages Tests	ITUT LMI or NTT LMI Messages Tests	RFC 1490 Messages Tests
LMI status LMI status Enquiry CLLM (Consolidated Link Layer Management) LMI Status 0 LMI status Enquiry 0 LMI multicast Reserved 1-15 Reserved 1008-18 Discard Eligibility FECN (Forward Explicit Congestion Notification) BECN (Backward Explicit Congestion Notification) RFC 1490	Status Enquiry Status Reserved 1-15 CLLM (Consolidated Link Layer Management) Discard Eligibility FECN (Forward Explicit Congestion Notification) BECN (Backward Explicit Congestion Notification)	Status Enquiry Status CLLM (Consolidated Link Layer Management) Orig Status Enquiry Orig Status LMI multicast Discard Eligibility FECN (Forward Explicit Congestion Notification) BECN (Backward Explicit Congestion Notification) RFC 1490 _IP (Dod) _Routed Frame _Bridged Frame _CLNP _Q.933

Preconfigured Frame Relay Simulation Tests

There are six pairs of simulation programs. One program of each pair simulates DTE/Eqpt and the other simulates DCE/Line:

- **Orig LMI Emulatn**
- **ANSI LMI Emulatn**
- **ITUT LMI Emulatn**
- **NTT LMI Emulatn**
- **Frame Relay Fox**
- **Auto User LMI/Auto Switch LMI**

Each of the first four pairs of tests deals with emulating a particular Frame Relay implementation. These tests are structured similarly except for variations in parameters to suit the Original, the ANSI, the ITUT, and the NTT LMI definitions. These tests request status and count responses every 10 seconds.

The Frame Relay Fox pair of tests sends the "Fox" message to DCLI 16 ten times per second.

The Auto User LMI test sets up the Internet Advisor to simulate the Frame Relay user-side of the Frame Relay user-network interface (UNI). This test also modifies the filter/counters used to analyze the Frame Relay traffic header. When this test is run, it activates the Frame Relay link by sending signaling messages to the switch (network) side. Based on the response from the switch, the test automatically determines whether the original LMI signaling or ANSI T1.617 Annex D is in use. After auto-configuring to the appropriate signaling type, the test also lets you transmit a fox message on a DLCI of your choice.

The Auto Switch LMI test sets up the Internet Advisor to simulate the Frame Relay network side of the Frame Relay user-network interface. This test also modifies the filter/counters used to analyze the Frame Relay header. When this test is run, it responds to signaling messages which are normally sent to the switch (network) side. Based on the messages which are received from the user side, the test automatically determines whether the original LMI signaling or ANSI T1.617 Annex D is in use. After auto-configuring to the appropriate signaling type the test can optionally respond to a Frame Relay frame by sending a frame on a DLCI of your choice.

SNA Tests

The **SNA Tests** file-folder icon (☐) provides access to the preconfigured SDLC (Synchronous Data Link Control) Frame Counts test and the SNA Decode. The user-definable hardware counters are preconfigured to gather unique statistics.

To use the preconfigured SDLC Frame Counts test, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **SDLC Tests** file-folder icon and press **ENTER**.

The Main Group\High Speed Analyzr\SNA Tests screen opens showing the SDLC Frame Counts test.

2. Highlight the **SDLC Frame Counts** page icon and press **ENTER**.

The test begins collecting data, and the Statistics and Counters screen is displayed. The **Interface Type** field of the Interface Setup Menu is automatically set to V.35. However, if you need to change it, or any other any interface setup parameters, press **F10** (Exit To Setup), make the necessary changes in the Interface Setup Menu, and then press **F7** (Stats & Countrs) to restart the test.

You can decode frames and view link level statistics using this test. The link level statistics are the same as what is shown in Table B-1 for the HDLC generic test.

3. To view the frame count information the counters provides, press **PgDn** or Down Arrow in the Statistics and Counters (Page 1 of 2) screen:

Table B-10: Counters in Preconfigured SDLC Frame Counts Test

Frame Counts
Bad Frames Count
Idle Suppres Suppress
Information Frames Count
Non-Information Frames Count
Supervisory Count
_RR (Receiver Ready) Count
_RNR (Receiver Not Ready) Count
_REJ (Reject) Count
Unnumbered Count
_SARM (Set Asynchronous Response Mode) Count
_SNRM (Set Normal Response Mode) Count
_UA (Unnumbered Acknowledgment) Count
_DISC (Disconnect) Count
_FRMR (Frame Reject) Count
_DM (Disconnect) Count
_UI (Unnumbered Information) Count

SMDS Monitor Test

The **SMDS Monitor** page icon (▤), available for T1 only, accesses a preconfigured test that provides statistics and decodes PDUs (Protocol Data Units) for the SMDS protocol. The counters are preconfigured in this test. To use the generic SMDS Monitor test, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **SMDS Monitor** page icon and press **ENTER**. The Interface Setup Menu is displayed.

2. Set the **Interface Type** field and the other fields in the Interface Setup Menu to match the network you are going to test.

3. Press **F9** (Start Run) to start the test.

4. To decode PDUs, press **F6** (Decode PDUs). Only level 2 SMDS is preconfigured to be displayed. If you want to see level 3, do the following:

    a. Press **F2** (Decode Config).

    b. Press **F2** (Select Decodes). This opens the Decode Loading/Unloading screen.

    c. Press Down Arrow until `SMDSL3.DEC` is highlighted, and then press **ENTER**. This changes the its load status to yes.

    d. Press **F10** (OK). This returns you to the Decode Configuration Menu.

    e. Highlight SMDS Layer 2, and press **ENTER**. This opens the SMDS Layer 2 Menu.

f. Change the **Next Protocol** field to SMDS Layer 3.

g. Press **F10** (OK).

h. Press **F10** (Exit Config).

5. Press **F8** (Line Status) to view current line status information, and press **PgDn** to view the line status history. The line status information for SMDS is the same as what is shown in Tables B-2 and B-3 for the HDLC generic test when it is configured for T1.

6. To view page 1 of the SMDS statistics, press **F7** (Stats & Countrs). To view page 2 of the SMDS statistics, press **PgDn** or Down Arrow from page 1.

Table B-11: Statistics in SMDS Monitor Test

Page 1 Statistics	Page 2 Statistics
BPVs (Bipolar Violations) Frame Bit Errors Frame Slips ESF (Extended Superframe) CRC Errors FEBEs (Far End Block Error) Maximum % BUSY PDUs (Protocol Data Units) Current % BUSY PDUs (Protocol Data Units) Minimum % BUSY PDUs (Protocol Data Units)	EMPTY PDUs (Protocol Data Units) BUSY PDUs (Protocol Data Units) Layer 2 CRC (Cyclic Redundancy Check) Error SSMs (Single Segment Message) BOMs (Beginning of Message) COMs (Continuation of Message) EOMs (End of Message) Payload Length > 44 Payload Length < 44 BIP8 (Bipolar 8) Error

Voice Monitor Test

The **Voice Monitor** page icon (▤) accesses a preconfigured test that monitors voice from a handset on channel 1 with AMI (Alternate Mark Inversion) line coding and ESF (Extended Super Frame) for T1, or that monitors voice from a handset on channel 1 with HDB3 (High Density Bipolar, 3 zeros) line coding for E1. The user-definable hardware filters and counters are not predefined in this test.

To use the **Voice Monitor** test, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **Voice Monitor** page icon and press **ENTER**. The Interface Setup Menu is displayed.

2. Configure the Interface Setup Menu to match your communications link (T1 or E1 only), and select one voice channel and the appropriate data channels. Refer to chapter 3, "Configuring the Internet Advisor," for more information on using the Interface Setup Menu.

3. Connect a handset to the Handset (RJ-11) connector on the side of the Internet Advisor.

Once you have configured the Interface Setup Menu, you can do such things as define filters and counters, decode data, view link level statistics, view current and history line status information, and view signalling bits (for T1). The link level statistics, line status information, and signalling bits information for the Voice Monitor test are the same as what is shown for the generic HDLC test in Tables B-1 through B-4.

NOTE

Using the Voice Monitor test is not the only way to perform voice testing. Voice testing is available for any T1/E1 test as long as a voice channel is specified in the **LN Voice Chan** and/or the **EQ Voice Chan** field of the Interface Setup Menu. (These fields are available when you choose either a fractional or a DDS selection in the **Data Channel** field.)

Simulation Demo

The **Simulation Demo** page icon ( ) accesses a preconfigured test that transmits data on a T1 or E1 line. The purpose of this test is to demonstrate the capabilities of the Internet Advisor (for example, decoding of data, gathering of statistics, and simulation of LAN traffic) without having to connect the Internet Advisor to a network. You do not need to configure this test; it is already configured to simulate on T1 or E1 and the counters are already preconfigured.

To use the Simulation Demo, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **Simulation Demo** page icon and press **ENTER**. The test starts and the Detailed Decode screen is displayed. You can view the Summary Decode screen by pressing **F6** (Summary Display).

2. You can view link level statistics by pressing **F7** (Stats & Countrs) and line status information by pressing **F8** (Line Status). The link level statistics and the current and history line status information for this test are the same as what is shown in Tables B-1 through B-4 for the generic HDLC test. Refer to chapter 4, "Monitoring," for more information on statistics.

3. To view the LAN over WAN count information provided by the preconfigured counters, press **PgDn** or Down Arrow from the Statistics and Counters (Page 1 of 2) screen:

Table B-12: Counters in Simulation Demo

Simulation Demo Counters
Non-IP
IP
IP Broadcast
_TCP
__Telnet
__FTP
__FTP data
__SMTP
_ICMP
_UDP
__SNMP
PPP
_Bridge PDU
_XNS
_IPX
BAS FCS

NOTE

Counter names which begin with one underscore, such as _TCP, are counters that count frames which are encapsulated in IP frames. Counter names which begin with two underscores, such as __FTP, are counters that count frames which are encapsulated in IP/TCP.

Message Editor

The **Message Editor** page icon (▤) accesses an editor that lets you create messages using the keyboard and softkeys or previously captured data. Refer to the section "Message Editor" in chapter 5, "Simulating," and to the section "Using the Message Editor" in chapter 6, "BERT Analyzer," for more information on the Message Editor.

View Data File and View Stats Log

The **View Data File** and **View Stats Log** page icons (▤) let you view previously captured and stored data and statistics. Selecting either of these page icons opens a screen in which you can specify the path and file name of the data or log file you want to view. The default path for stored data files and log files is `C:\HPTOOLS\DATA`, although you can save data and logs anywhere you want. Refer to chapter 4, "Monitoring," for more information.

The statistics logs can be used in conjunction with the HP Internet Reporter (an optional software package) to baseline traffic on your network. The HP Internet Reporter is a management tool that provides a broad collection of capability to develop reports and a network base line. It is especially useful in the verification of network health and performance and for capacity planning. Contact your Hewlett-Packard sales representative for more information.

Log ABCD Bits (for T1 Only)

The **Log ABCD Bits** page icon (▤) is available only on Internet Advisors configured with T1 operating systems. It is a T1 monitor utility program that lets you configure the T1 hardware to capture the in-band signalling bits on each channel of a T1/56 kbps data stream. Simultaneous simulation is not possible.

To use the **Log ABCD Bits** program, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **Log ABCD Bits** page icon and press **ENTER**.

   When the program begins, you are given four choices:

   - **1: Configure Hardware** - This configures the interface.
   - **2: Monitor Signal Bits** - This starts monitoring.
   - **3: Review Saved Buffer** - This causes the DOS Edit program to open the file `C:\HPTOOLS\DATA\SIGMON.LOG`
   - **4: Exit** - This returns you to Toolkit.

2. Press **1** (Configure Hardware) to configure the hardware.

3. If you want to start monitoring signal bits, press **2** (Monitor Signal Bits). The monitor screen is shown in figure B-5.

   a. Press **F3** (ESF) to set the mode to ESF (Extended Super Frame), or press **F4** (D4) to set the mode to D4 (Conventional Super Frame). When the program is configured for ESF, the A, B, C, and D bits are logged. When it is configured for D4, only A and B bits are available.

   b. Press **F1** (Start) to begin capturing data.

   c. Press **F2** (Stop) to stop capturing data.

d. Press **F9** (Store) to save the data to the `C:\HPTOOLS\DATA\SIGMON.LOG` file.

This file is a DOS text file. The entries in this file look like Figure B-6. Each change of a signalling bit on any of the channels causes a new log entry. Each log entry is time stamped relative to the beginning time of the test so that you can see when signalling states change.

e. Press **F10** (Exit) to return to the original menu of four choices.

```
              Time: Thu Mar 30 10:02:25 1995

 Eqpt In
1    2    3    4    5    6    7    8    9    10   11   12
ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
0001 0100 0110 1100 0000 0010 0001 1001 1111 0100 0011 1000
13   14   15   16   17   18   19   20   21   22   23   24
ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
0101 0110 0100 1101 0100 1010 0011 1000 1011 0101 1011 1010

 Line In
1    2    3    4    5    6    7    8    9    10   11   12
ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
1001 1100 1110 0100 1000 1010 1001 0001 0111 1100 1011 0000
13   14   15   16   17   18   19   20   21   22   23   24
ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
0000 0101 0111 1101 0001 0011 0000 1000 1110 0101 0010 1001

                      Buffer
                      Capturing: Yes
                      Entries:   931


F1:Start F2:Stop F3:ESF F4:D4               F9:Store F10:Exit
```

Figure B-5: Log ABCD Bits Screen

4. Press **3** (Review Saved Buffer) to view the `C:\HPTOOLS\DATA\SIGMON.LOG` file. The DOS Editor displays the log file. An example is shown in Figure B-6.

   a. To exit the log file, press **ALT, F, X.**

NOTE

To permanently save a log file, copy the `SIGMON.LOG` file to a file name of your choice by using DOS or by using the Mass Store Functions of the Toolkit (described in the "Mass Store Functions" section of chapter 7, "The Toolkit User Interface."

```
Start Time: Thu Mar 30 16:23:38 1995

Eqpt In  0.00038
  1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111
  1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111
Line In  0.00045
  1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111
  1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111 1111
Eqpt In  0.03040
  1111 1111 1111 1111 1111 1111 1101 1111 1101 1101 1101 1111
  1111 1101 1101 1101 1101 1111 1101 1111 1101 1101 1111 1101
Line In  0.03046
  1111 1111 1111 1111 1101 1111 1101 1111 1101 1101 1101 1111
  1111 1101 1101 1101 1101 1111 1101 1111 1101 1101 1111 1101
Eqpt In  0.03091
  1101 1101 1101 1101 1101 1111 1101 1111 1101 1101 1101 1111
  1111 1101 1101 1101 1101 1111 1101 1111 1101 1101 1111 1101
Line In  0.03098
  1101 1101 1101 1101 1101 1111 1101 1111 1101 1101 1101 1111
  1111 1101 1101 1101 1101 1111 1101 1111 1101 1101 1111 1101
```

Figure B-6: SIGMON.LOG File

5. Press **4** (Exit) to return to the Toolkit.

LAN Over WAN Tests

Six file-folder icons ( ) in the right-most column of the Main Group\High Speed Analyzr screen (**Router Tests, Bridge Tests, PPP Tests, HDLC Tests, X.25 Tests,** and **Frame Relay Tests**) provide access to groups of tests that are concerned with LAN traffic on WAN links.

The link level statistics available in all these tests are the same as the what is available in the generic HDLC test (refer to Table B-1). The additional unique measurements available in these tests are provided by the user-definable counters, which are preconfigured to provide protocol- and vendor-specific counts.

Router Tests

To use the preconfigured LAN over WAN Router tests, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **Router Tests** file-folder icon and press **ENTER**.

The Main Group\High Speed Analyzr\Router Tests screen is displayed in which there are additional file-folders. Each of these file-folder icons leads to a group of tests that are vendor-specific (for example, Cisco). This is necessary because router manufacturers have used varying encapsulation techniques to carry LAN traffic over WAN links.

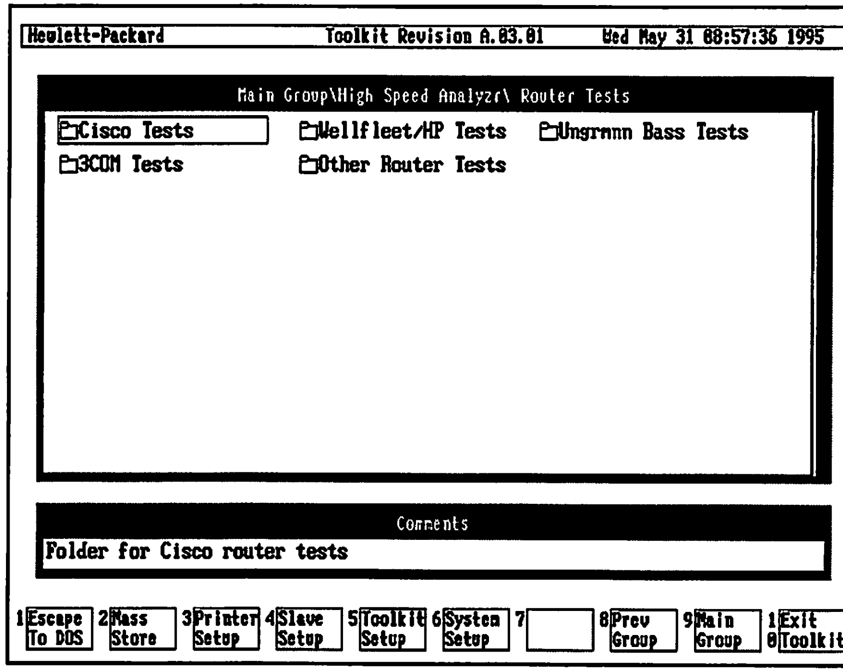


Figure B-7: LAN Over WAN Router Tests

2. Highlight one the file-folder icons and press **ENTER**. A screen is displayed with these file-folder icons:

   - **LAN Traffic Counts**
   - **AppleTalk Services**
   - **TCP/IP Services**
   - **Novell Services**

Beneath each of these file-folders icons are page icons that represent individual tests for various interfaces: **V35 Monitor, V36 Monitor, V24 Monitor**, and possibly **T1 Monitor** or **CEPT E1 Monitor**. Figure B-8 shows the Cisco tests.

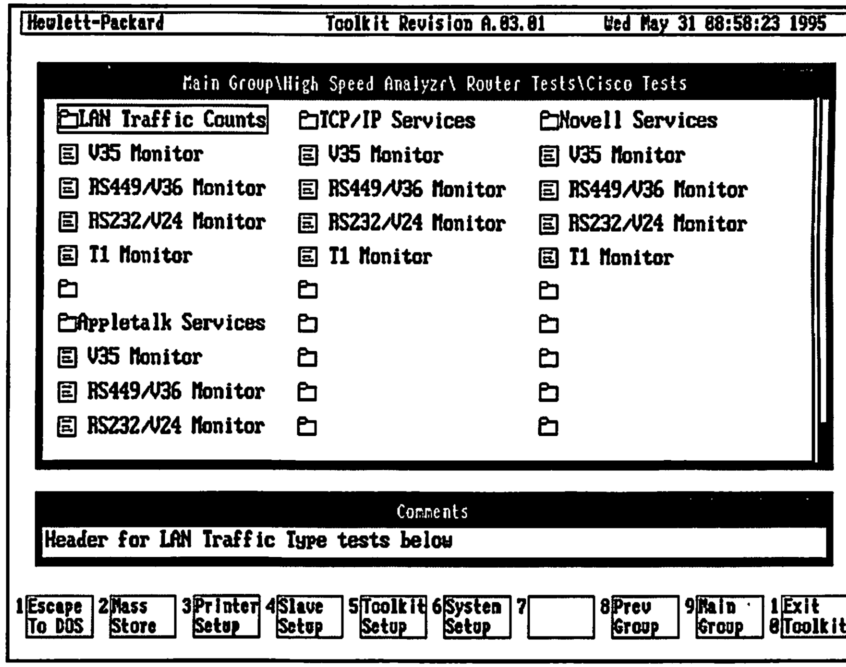


Figure B-8: Cisco Router Tests

3. Highlight one of the page icons and press **ENTER** to start the test.

All the V-Series monitor tests open in the Statistics and Counters screen and begin collecting data as soon as they are selected. If you need to change any interface setup parameters, press **F10** (Exit To Setup), make the necessary changes in the Interface Setup Menu, and then press **F7** (Stats & Countrs) to restart the test.

The **T1 Monitor** and the **CEPT E1 Monitor** tests open in the Interface Setup Menu so you can configure the interface before proceeding.

All the tests provide decode information and link level statistics similar to the generic HDLC test (refer to Table B-1). In addition, they provide protocol-specific counts through the preconfigured counters.

4. To view protocol-specific counts, from Statistics and Counters (Page 1 of 2), press **PgDn** or the Down Arrow. Table B-13 summarizes the information provided by the preconfigured counters in any of the Cisco, Wellfleet/HP, Ungrmnn Bass, 3Com, or Other Router **LAN Traffic Counts** tests:

Table B-13: Counters in LAN Traffic Counts Router Tests

LAN Traffic Counts
IP
IP Broadcast
Novell (IPX)
XNS (IDP)
X.25 Level 3
ARP (IP)
DECnet
DEC LAT
Banyan
DEC LanBrdg
3Com
AppleTalk
SNA
SNMP Mon
SNMP Traf
Bridged Traf

NOTE

Non-standard encapsulations may cause the counters not to count. If this occurs, you may need to modify the counters. Refer to the section "Filters and Counters" in chapter 3, "Configuring the Internet Advisor," for information on modifying the filters/counters.

Table B-14 summarizes the information provided by the preconfigured counters in any of the Cisco, Wellfleet/HP, Ungrmnn Bass, 3Com, or Other Router **AppleTalk Services, TCP/IP Services,** and **Novell Services** Router tests:

Table B-14: Counters in AppleTalk, TCP/IP, and Novell Services

AppleTalk Services	TCP/IP Services	Novell Services
Non-AP	Non-IP	Non-Novell
AARP	IP	SPX
DDP	IP Broadcast	IPX
_Invalid	_TCP	_Echo (Dest)
_AEP Req	__Telnet	_Echo (Src)
_AEP Reply	__FTP	_RIP (Dest)
_RTMP Req	__FTP Data	_RIP (Src)
_RTMP Resp	__SMTP	_SAP (Dest)
_NBP	__Rlogin	_SAP (Src)
_AIP	_ICMP	_NCP (Dest)
_ZIP	_UDP	_NCP (Src)
_DOD IP	_RIP	_NetB (Dest)
	__DNS	_NetB (Src)
	__TFTP	_Diag (Dest)
	__SNMP Mon	_Diag (Src)
	__SNMP Trap	

NOTE

Counter names which begin with one underscore, such as _TCP, are counters that count frames which are encapsulated in IP frames. Counter names which begin with two underscores, such as __FTP, are counters that count frames which are encapsulated in IP/TCP.

Bridge Tests

To use the preconfigured LAN over WAN Bridge tests, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **Bridge Tests** file-folder icon and press **ENTER**. A screen opens with these file-folder icons:

   - **LAN Traffic Counts**
   - **AppleTalk Services**
   - **TCP/IP Services**
   - **Novell Services**

Beneath each of these file-folders icons are page icons that represent individual tests for various interfaces: **V35 Monitor, V36 Monitor, V24 Monitor**, and possibly **T1 Monitor** or **CEPT E1 Monitor**.

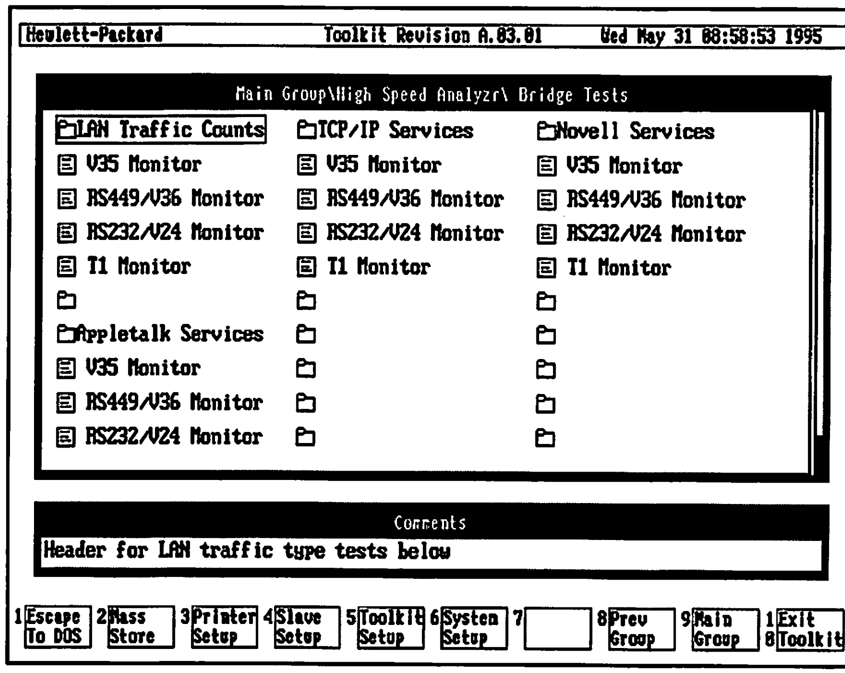


Figure B-9: LAN Over WAN Bridge Tests

2. Highlight one of the page icons and press **ENTER** to start the test.

All the V-Series monitor tests open in the Statistics and Counters screen and begin collecting data as soon as they are selected. If you need to change any interface setup parameters, press **F10** (Exit To Setup), make the necessary changes in the Interface Setup Menu, and then press **F7** (Stats & Countrs) to restart the test.

The **T1 Monitor** and the **CEPT E1 Monitor** tests open in the Interface Setup Menu so you can configure the interface before proceeding.

All the tests provide decode information and link level statistics similar to the generic HDLC test (refer to Table B-1). In addition, they provide protocol-specific counts through the preconfigured counters.

3. To view the protocol-specific counts, from the Statistics and Counters (Page 1 of 2) screen, press **PgDn** or the Down Arrow.

Table B-15: Counters in Bridge Monitor Tests

LAN Traffic Counts	AppleTalk Services	TCP/IP Services	Novell Services
802.3 Bridge	Non-APPLE	Non-IP	Non-Novell
802.5 Bridge	AARP	IP	SPX
ARP (IP)	DDP	IP Broadcast	IPX
IP	_Invalid	_TCP	_Echo (Dest)
IP Broadcast	_AEP Req	__Telnet	_Echo (Src)
Novell (IPX)	_AEP Reply	__FTP	_RIP (Dest)
Novell (IPX)	_RTMP Req	__FTP Data	_RIP (Src)
XNS (IDP)	_RTMP Resp	__SMTP	_SAP (Dest)
DECnet	_NBP	__Rlogin	_SAP (Src)
DEC LAT	_AIP	_ICMP	_NCP (Dest)
DEC LanBrdg	_ZIP	_UDP	_NCP (Src)
Banyan	_DOD IP	_RIP	_NetB (Dest)
3Com		_DNS	_NetB (Src)
AppleTalk		_TFTP	_Diag (Dest)
SNA		_SNMP Mon	_Diag (Src)
Broadcast		_SNMP Trap	

NOTE

Counter names which begin with one underscore, such as _TCP, are counters that count frames which are encapsulated in IP frames. Counter names which begin with two underscores, such as __FTP, are counters that count frames which are encapsulated in IP/TCP.

PPP (Point-to-Point Protocol) Tests

To use the preconfigured LAN over WAN PPP tests, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **PPP Tests** file-folder and press **ENTER**. A screen opens in which there are additional file-folder icons:

   - **LAN Traffic Counts**
   - **AppleTalk Services**
   - **TCP/IP Services**
   - **Novell Services**

   Beneath each of these file-folders icons are page icons that represent individual tests for various interfaces: **V35 Monitor, V36 Monitor, V24 Monitor,** and possibly **T1 Monitor** or **CEPT E1 Monitor.** Figure B-10 shows the PPP tests.

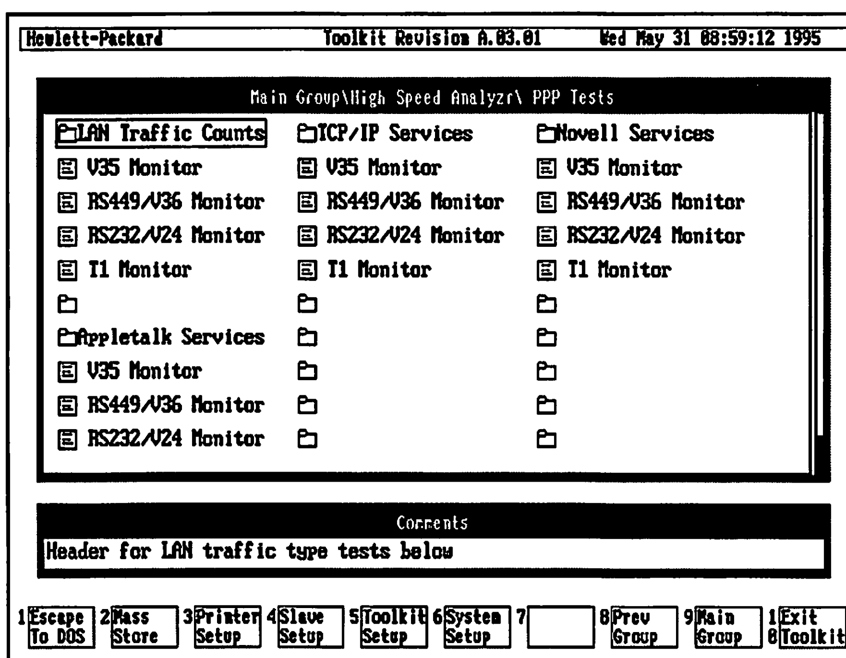


Figure B-10: LAN Over WAN PPP Tests

2. Highlight one of the page icons and press **ENTER** to start the test.

All the V-Series monitor tests open in the Statistics and Counters screen and begin collecting data as soon as they are selected. If you need to change any interface setup parameters, press **F10** (Exit To Setup), make the necessary changes in the Interface Setup Menu, and then press **F7** (Stats & Countrs) to restart the test.

The **T1 Monitor** and the **CEPT E1 Monitor** tests open in the Interface Setup Menu so you can configure the interface before proceeding.

All the tests provide decode information and link level statistics similar to the generic HDLC test (refer to Table B-1). In addition, they provide protocol-specific counts through the preconfigured counters.

3. To view the protocol-specific counts, from the Statistics and Counters (Page 1 of 2) screen, press **PgDn** or the Down Arrow.

Table B-16: Counters in PPP Monitor Tests

LAN Traffic Counts	AppleTalk Services	TCP/IP Services	Novell Services
IP	Non-APPLE	Non-IP	Non-Novell
IP Broadcast	DDP	IP	SPX
Novell (IPX)	_Invalid	IP Broadcast	IPX
XNS (IDP)	_AEP Req	_TCP	_Echo (Dest)
DECnet PhIV	_AEP Reply	__Telnet	_Echo (Src)
AppleTalk	_RTMP Req	__FTP	_RIP (Dest)
OSI Network	_RTMP Resp	__FTP Data	_RIP (Src)
Banyan	_NBP	__SMTP	_SAP (Dest)
PPP LCP	_AIP	__Rlogin	_SAP (Src)
Password Ath	_ZIP	_ICMP	_NCP (Dest)
Link Quality	_DOD IP	_UDP	_NCP (Src)
IP Control		__RIP	NetB (Dest)
Novell Cntrl		__DNS	NetB (Src)
XNS Control		__TFTP	Diag (Dest)
Bridging PDU		__SNMP Mon	Diag (Src)
		__SNMP Trap	

NOTE

Counter names which begin with one underscore, such as _TCP, are counters that count frames which are encapsulated in IP frames. Counter names which begin with two underscores, such as __FTP, are counters that count frames which are encapsulated in IP/TCP.

HDLC Tests

To use the preconfigured LAN over WAN HDLC tests, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **HDLC Tests** file-folder icon and press **ENTER**. A screen opens in which there are additional file-folder icons:

   - **LAN Traffic Counts**
   - **AppleTalk Services**
   - **TCP/IP Services**
   - **Novell Services**

   Beneath each of these file-folders icons are page icons that represent individual tests for various interfaces (**V35 Monitor, V36 Monitor, V24 Monitor,** and possibly **T1 Monitor** or **CEPT E1 Monitor**) as shown in Figure B-11.

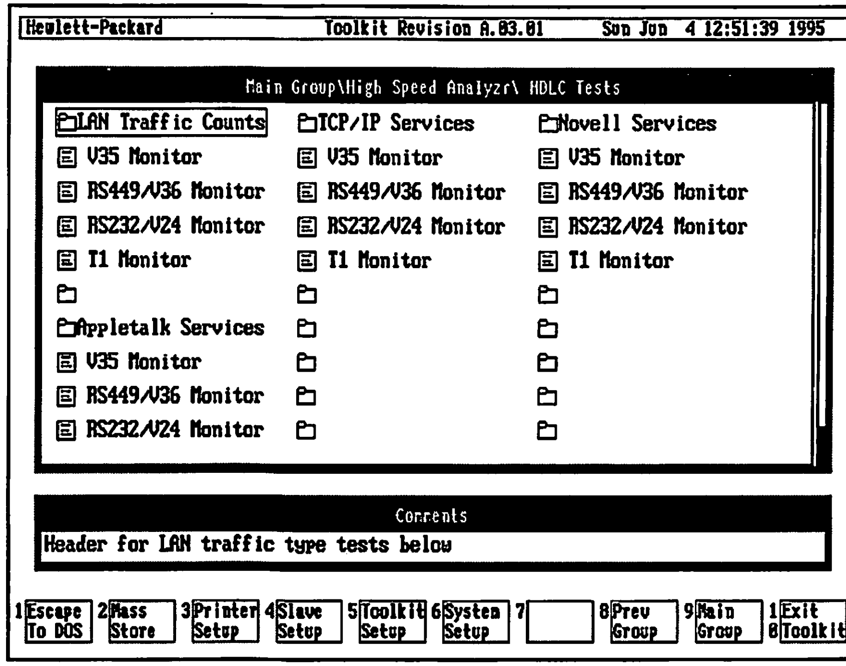


Figure B-11: LAN Over WAN HDLC Tests

2. Highlight one of the page icons and press **ENTER** to start the test.

All the V-Series monitor tests open in the Statistics and Counters screen and begin collecting data as soon as they are selected. If you need to change any interface setup parameters, press **F10** (Exit To Setup), make the necessary changes in the Interface Setup Menu, and then press **F7** (Stats & Countrs) to restart the test.

The **T1 Monitor** and the **CEPT E1 Monitor** tests open in the Interface Setup Menu so you can configure the interface before proceeding.

All the tests provide decode information and link level statistics similar to the generic HDLC test (refer to Table B-1). In addition, they provide protocol-specific counts through the preconfigured counters.

3. To view the protocol-specific counts, from the Statistics and Counters (Page 1 of 2) screen, press **PgDn** or the Down Arrow.

Table B-17: Counters in HDLC Monitor Tests

LAN Traffic Counts	AppleTalk Services	TCP/IP Services	Novell Services
IP	Non-AP	Non-IP	Non-Novell
IP Broadcast	AARP	IP	SPX
Novell (IPX)	DDP	IP Broadcast	IPX
XNS (IDP)	_Invalid	_TCP	_Echo (Dest)
X.25 Level 3	_AEP Req	__Telnet	_Echo (Src)
ARP (IP)	_AEP Reply	__FTP	_RIP (Dest)
DECnet	_RTMP Req	__FTP Data	_RIP (Src)
DEC LAT	_RTMP Resp	__SMTP	_SAP (Dest)
Banyan	_NBP	__Rlogin	_SAP (Src)
DEC LanBrdg	_AIP	_ICMP	_NCP (Dest)
3Com	_ZIP	_UDP	_NCP (Src)
AppleTalk	_DOD IP	__RIP	_NetB (Dest)
SNA		__DNS	_NetB (Src)
SNMP Mon		__TFTP	_Diag (Dest)
SNMP Trap		__SNMP Mon	_Diag (Src)
Bridged Traf		__SNMP Trap	

NOTE

Counter names which begin with one underscore, such as _TCP, are counters that count frames which are encapsulated in IP frames. Counter names which begin with two underscores, such as __FTP, are counters that count frames which are encapsulated in IP/TCP.

X.25 Tests

To use the preconfigured LAN over WAN X.25 tests, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **X.25 Tests** file-folder icon and press **ENTER**. A screen opens in which there are three file-folder icons:

- **LAN Traffic Stats**
- **Bridged Traffic**
- **TCP/IP Services**

Beneath each of these file-folders icons are page icons that represent individual tests for various interfaces: **V35 Monitor, V36 Monitor, V24 Monitor,** and **T1 Monitor** or **CEPT E1 Monitor.**

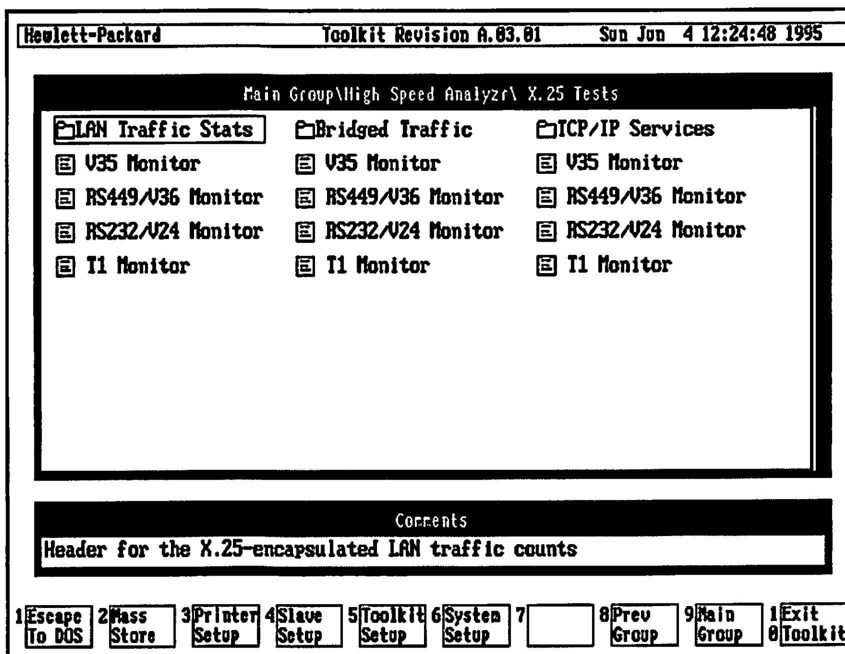


Figure B-12: LAN Over WAN X.25 Tests

2. Highlight one of the page icons and press **ENTER** to start the test.

   All the V-Series monitor tests open in the Statistics and Counters screen and begin collecting data as soon as they are selected. If you need to change any interface setup parameters, press **F10** (Exit To Setup), make the necessary changes in the Interface Setup Menu, and then press **F7** (Stats & Countrs) to restart the test.

   The **T1 Monitor** and the **CEPT E1 Monitor** tests open in the Interface Setup Menu so you can configure the interface before proceeding.

   All the tests provide decode information and link level statistics similar to the generic HDLC test (refer to Table B-1). In addition, they provide protocol-specific counts through the preconfigured counters.

3. To view the protocol-specific counts, from the Statistics and Counters (Page 1 of 2) screen, press **PgDn** or the Down Arrow.

Table B-18: Counters in X.25 Monitor Tests

LAN Traffic Stats	Bridged Traffic	TCP/IP Services
Non-IP	IP	Non-IP
IP	IP Broadcast	IP
IP Broadcast	Novell (IPX)	IP Broadcast
Novell/XNS	XNS (IDP)	_TCP
SNMP Mon	X.25 Level 3	__Telnet
SNMP Trap	ARP (IP)	__FTP
	DECnet	__FTP Data
	DEC LAT	__SMTP
	Banyan	__Rlogin
	DEC LanBrdg	_ICMP
	3Com	_UDP
	AppleTalk	__RIP
	SNA	__DNS
	SNMP Mon	__TFTP
	SNMP Trap	__SNMP Mon
	Bridged Traf	__SNMP Trap

NOTE Counter names which begin with one underscore, such as _TCP, are counters that count frames which are encapsulated in IP frames. Counter names which begin with two underscores, such as __FTP, are counters that count frames which are encapsulated in IP/TCP.

Frame Relay Tests

To use the preconfigured LAN over WAN Frame Relay tests, do the following:

1. In the Main Group\High Speed Analyzr screen, highlight the **Frame Relay Tests** file-folder icon and press **ENTER**. A screen opens in which there are additional file-folder icons:

   - **LAN Traffic Counts**
   - **AppleTalk Services**
   - **TCP/IP Services**
   - **LMI/RFC 1490 Traff**
   - **Novell Services**

   Beneath each of these file-folders icons are page icons that represent individual tests for various interfaces: **V35 Monitor, V36 Monitor, V24 Monitor**, and possibly **T1 Monitor** or **CEPT E1 Monitor.**

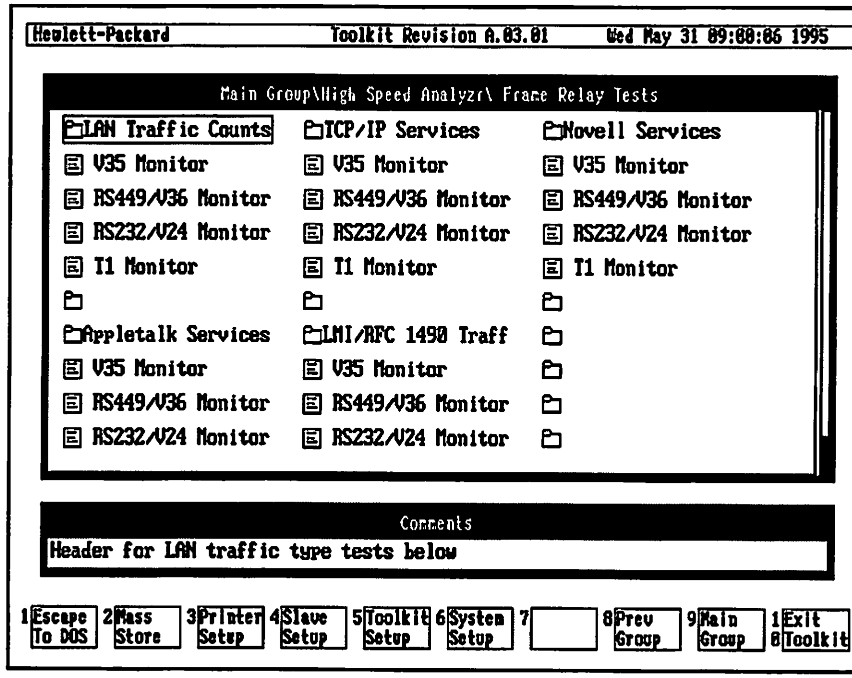


Figure B-13: LAN Over WAN Frame Relay Tests

2. Highlight one of the page icons and press **ENTER** to start the test.

All the V-Series monitor tests open in the Statistics and Counters screen and begin collecting data as soon as they are selected. If you need to change any interface setup parameters, press **F10** (Exit To Setup), make the necessary changes in the Interface Setup Menu, and then press **F7** (Stats & Countrs) to restart the test.

The **T1 Monitor** and the **CEPT E1 Monitor** tests open in the Interface Setup Menu so you can configure the interface before proceeding.

All the tests provide decode information and link level statistics similar to the generic HDLC test (refer to Table B-1). In addition, they provide protocol-specific counts through the preconfigured counters.

3. To view the protocol-specific counts, from the Statistics and Counters (Page 1 of 2) screen, press **PgDn** or the Down Arrow.

Table B-19: Counters in Frame Relay Monitor Tests

LAN Traffic Counts	AppleTalk Services	TCP/IP Services	LMI/RFC 1490 Traff	Novell Services
IETF RFC1490	IETF RFC1490	IETF RFC1490	Stat Enquiry	IETF RFC1490
IP	Non-APPLE	Non-IP	Status	Non-Novell
IP Broadcast	AARP	IP	CLLM	SPX
Novell (IPX)	DDP	IP Broadcast	Orig StatEnq	IPX
XNS (IDP)	_Invalid	_TCP	Orig Status	_Echo (Dest)
X.25 Level 3	_AEP Req	__Telnet	LMI multicst	_Echo (Src)
ARP (IP)	_AEP Reply	__FTP	Discard Elig	_RIP (Dest)
DECnet	_RTMP Req	__FTP Data	FECN	_RIP (Src)
DEC LAT	_RTMP Resp	__SMTP	BECN	_SAP (Dest)
Banyan	_NBP	__Rlogin	RFC 1490	_SAP (Src)
DEC LanBrdg	_AIP	_ICMP	_IP (DoD)	_NCP (Dest)
3Com	_ZIP	_UDP	_Routed Frm	_NCP (Src)
AppleTalk	_DOD IP	__RIP	_Bridged Frm	_NetB (Dest)
SNA		__DNS	_CLNP	_NetB (Src)
SNMP Mon		__TFTP	_Q.933	_Diag (Dest)
Bridged Traf		__SNMP Mon		_Diag (Src)

NOTE

Counter names which begin with one underscore, such as _TCP, are counters that count frames which are encapsulated in IP frames. Counter names which begin with two underscores, such as __FTP, are counters that count frames which are encapsulated in IP/TCP.

C

Specifications

Specifications

This appendix outlines the specifications and performance information of the Internet Advisor. The following sections are provided:

- Decoded Protocol Fields
- Physical Characteristics

Decoded Protocol Fields

The Internet Advisor decodes the most significant fields of the LAN traffic found on WAN links. The following is a lists of the protocol stacks that have fields decoded:

- Appletalk Stack
- DARPA, Novell, and XNS Stacks
- DECNET Stack
- SNA Stack

Appletalk Stack

ALAP	Source Node Destination Node Protocol Type
AARP	Command Protocol Type Hardware Type
ADSP	Control Code Probe/Acknowledgment Source ID Send Sequence Receive Sequence Received Window Description Bits Version Destination ID Attention Code
AEP	Function

ATP	Command Control Bits Sequence Number Bit Map Transportation ID User Bytes Protocol
DDP	Socket Net Hop Count Checksum

DARPA, Novell, and XNS Stacks

BootP	Header Type Header Length Client Your Server GW
Domain Name Server	Domain Opcode Flags Queries Answers Name Server Additional RRs
EGP	Type Code Status Checksum

Note: All 9 message types are decoded, but the autonomous system number and the sequence number are not decoded.

Ethernet	Source Address Destination Address Length (802.3)/Ethertype

ICMP	Type (The most common) Code Checksum

Note: IP headers contained in ICMP Data Fields are NOT decoded.

IEEE(802.2)	Source SAP Destination SAP Control Request Sequence Number SNAP
IEEE(802.5)	Source Address Destination Address Routing Info.
IP	Header Length Type of service Total Length Fragment Offset Flags Protocol Type Checksum Source Address Destination Address Options Time To Live
IPX	Checksum Length Transport Control Packet Type Destination Address Source Address Socket Watchdog
IPX_RIP	Operation Net Delay Hops

IPX_SAP	Operation Type of File Server Name Network Node
NCP	Request Type Reply Type Connection Number Sequence Number Request Code
NetBIOS Datagram (RFC 1001/1002)	Type Length ID Offset Flags
Netblt (Network Block Transfer)	Version Type Length lp fp Checksum
NSP (Name Layer)	Name Reply Name Request Address Name Code Error Code
NTP (Time Protocol)	Time Reply Time Request
OSPF	Version Type Length Router ID Area ID Auth1 Auth2 Checksum Autype

RIP (XNS Version)	Routes Request Response Network Cost
RVD	Error Request
SNMP	Sequence Version Comm Length Application Type SNMP Variable and Value ASN.1 Type Decoding

SPX shown but no further decode.

SunRPC	XID Version Procedure Program Credential Bytes Verification Call Machine uid gid Groups Unix Stamp
TCP	Source Port Destination Port Sequence Number Window Acknowledgment Number Urgent Pointer Flags Checksum Options Telnet (IAC Control Sequence) Header Length

TFTP	Opcode File Name Mode Error
UDP	Source Name Destination Name Length Checksum
XNS_IDP	Checksum Length Hops Protocol Socket Network and Node Packet Type
XNS_SPP	Data Length ID Sequence Acknowledgment Allocation Control Type

DECNET Stack

Decnet (Only Top Layer, Routing, and Data Layers are decoded)

DNA-V4	Length Padding Type Source Initialization Message Verification Blocking Request Max. Block Size Version ECO Hello Timer Test Data Length Segment Count Node Hops

	Cost Area Router Priority State
DNA_MOP	Length Type

SNA Stack

SNA	Transmission Header for FID0, FID1, FID2, FID3, and FID4 Request/Response Header Request/Response Unit
NetBIOS	Length

The following frames are decoded:

AddGroupName
NameInConflict
StatusQuery
Datagram
Datagrambkst
NameQuery
AddNameResp
Name Recog.
Status Resp.
Data Ack.
Data First Middle
Data Only Last
Session Confirm
Session End
Session Init.
NoReceive
Session Alive

SMB	Function Return Code Return Class Netpath PID Parameter Count Parms Buffer Length

Physical Characteristics

The following are the physical characteristics of the Internet Advisor:

Dimensions:

height	8.5cm. (3.4in.) for WAN
	11.9cm. (4.9in.) for WAN/LAN
width	30.0cm. (12.0in.)
depth	29.0cm. (11.5in.)

Temperature:

operating	+5°C to +40°C (+41°F to +104°F)
storage	-25°C to +60°C (-13°F to +140°F)

Humidity:

operating	20% to 80%
storage	5% to 90%
	(no condensation allowed)

T1/E1 Interfaces

The physical characteristics for the two high speed interfaces (T1 and E1) are shown in the following table.

Table C-1: T1/E1 Physical Interface Specifications

	T1	E1
Access Points	Support of DS1 (T1.403) Network Interface with line build out, CSU/DSU monitor jacks, and equipment side DSX-1.	Supports access to the Network Interface and equipment side interface.
Connectors	- Mini-bantams for access at the CSU/DSU, RJ-48C - 15 pin DSUB connectors for access to NI or DSX-1 and EIA-232 (optional) - V.35, and EIA-449 for access to equipment side interfaces. - WECO 310 jacks are supported through the use of adaptors.	- Siemens 3 pin via adaptor cable to BR2 connectors, 75 ohm standard BNC, or Siemens 1.6/5.6 mm BNC for access to the NI and V.24 - V.35, and V.36 for access to equipment side.
Modes	Monitor (terminated), bridged, through monitor, and drop and insert (dual direction).	Monitor (terminated), through monitor, and drop and insert (dual direction).
Clock Recovery	With and without jitter transfer function filtering.	With and without jitter transfer function filtering.
Line Code	AMI and B8ZS	AMI and HDB3
Framing	D4 and ESF	CCS with CRC-4 and CCS without CRC-4.
Alarms	Loss of Signal (LOS), Out of Frame (OOF), Alarm Indication Signal (AIS), and Yellow Alarm.	Loss of Signal (LOS), Out of Frame (OOF), Alarm Indication Signal (AIS), and Yellow Alarm.
Signalling	A, B, C, and D	

V-Series Interfaces

The V-Series Interfaces are the RS-232, RS-449, and V.35 interfaces. The following signals are analyzed on the V-Series Interfaces:

Table C-2: V-Series Functions

Function	RS-232	V.35	RS-449
Send Data	DTE	SD	SD
Receive Data	DCE	RD	RD
DTE/Send Timing (DCE)	TC	SCT	ST
DCE/Receive Timing (DCE)	RC	SCR	RT
DTE/Send Timing (DTE)	ETC	SCE	TT
Request to Send	RTS	RS	RS
Clear to Send	CTS	CS	CS
Data Terminal Ready	DTR	DTR	TR
Data Set/Mode Ready	DSR	DSR	DM
Carrier Detect/Rec. Ready	CD	CD	RR

Table C-3: V-Series Functions for High Speed External Pods Only

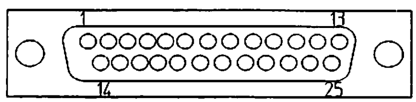
Function	RS-232	V.35	RS-449
Local Loopback (Drv)		LLB	LLB
Remote Loopback (Drv)		RLB	RLB
Test Mode (Mon)		TM	TM

Standard Connector Pinouts

The Internet Advisor comes with the following standard connectors. The pin assignments are listed in this section to assist you with your testing requirements.

- RS-232C/V.24
- RS449
- V.35

RS-232C/V.24



RS232

Figure 0-1: RS-232C Interface Connector Pins Assignment

Table C-4: RS-232C Interface Connector Pins Assignment

PIN	CCITT CIRCUIT	CIRCUIT FUNCTION	PIN	CCITT CIRCUIT	CIRCUIT FUNCTION
1	101	Protective Ground	14	118	Secondary Transmitted Data
2	103	Transmitted Data	15	114	Transmission Signal Element Timing (DCE Source)
3	104	Received Data	16	119	Secondary Received Data
4	105	Request to Send	17	115	Receiver Signal Element Timing (DCE Source)
5	106	Clear to Send	18		Unassigned
6	107	Data Set Ready	19	120	Secondary Request to Send
7	102	Signal Ground (common return)	20	108.2	Data Terminal Ready
8	109	Received Line Signal Detector	21	110	Signal Quality Detector
9		(Reserved for Data Set Testing)	22	125	Ring Indicator
10		(Reserved for Data Set Testing)	23	111/112	Data Signal Rate Selector (DTE Source)
11		Unassigned	24	113	Transmit Signal Element Timing (DTE Source)
12	122	Secondary Received Line Signal Detector	25		Unassigned
13	121	Secondary Clear to Send			

RS-449

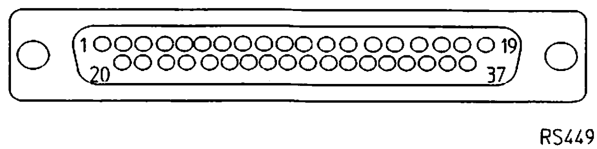


Figure 0-2: RS-449 Interface Connector Pins Assignment

Table C-5: RS-449 Interface Connector Pins Assignment

PIN	CIRCUIT NAME	PIN	CIRCUIT NAME
1	Shield	20	Receive Common
2	Send Timing	21	Spare
3	Spare	22	Send Data
4	Send Data	23	Send Timing
5	Send Timing	24	Receive Data
6	Receive Data	25	Request to Send
7	Request to Send	26	Receive Timing
8	Receive Timing	27	Clear to Send
9	Clear to Send	28	Terminal in Service
10	Local Loopback	29	Data Mode
11	Data Mode	30	Terminal Ready
12	Terminal Ready	31	Receiver Ready
13	Receiver Ready	32	Select Standby
14	Remote Loopback	33	Signal Quality
15	Incoming Call	34	New Signal
16	Select Frequency/Signal Rate Selector	35	Terminal Timing
17	Terminal Timing	36	Standby Indicator
18	Test Mode	37	Send Common
19	Signal Ground		

V.35

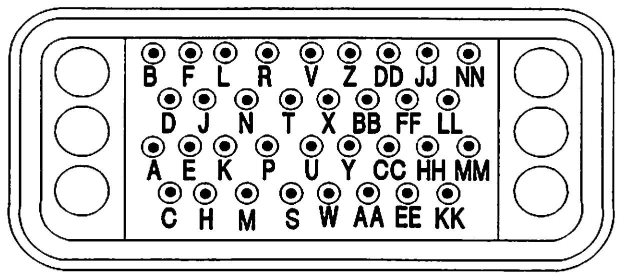


Figure 0-3: V.35 Interface Connector Pins Assignment

Table C-6: V.35 Interface Connector Pins Assignment

PIN	CIRCUIT NAME
A	Chassis Ground
B	Signal Ground
C	Request to Send
D	Clear to Send
E	Data Set Ready
F	Receive Line Signal Detect
P	Transmit Data (A)
R	Received Data (A)
S	Transmit Data (B)
T	Received Data (B)
U	Terminal Timing (A)
V	Receive Timing (A)
W	Terminal Timing (B)
X	Receive Timing (A)
Y	Transmit Timing (A)
AA	Transmit Timing (B)

Interface Pin-Out Comparison

Table C-7: Interface Pin-Out Comparison

RS-232C/CCITT V.24	CCITT V.35	RS-449
25 Pin	**34 Pin**	**37 Pin**
1–Protective Ground	A–Protective Ground	1–Shield 37–Send Common
2–Transmitted Data	P–Transmit Data (A) S–Transmit Data (B)	4–Send Data (A) 22–Send Data (B)
3–Received Data	R–Received Data (A) T–Received Data (B)	6–Received Data(A) 24–Received Data (B)
4–Request to Send	C–Request to Send	7–Request to Send (A) 25–Request to Send (B)
5–Clear to Send	D–Clear to Send	9–Clear to Send (A) 27–Clear to Send (B)
6–Data Set Ready	E–Data Set Ready	11–Data Mode (A) 29–Data Mode (B)
7–Signal Ground	B–Signal Ground	19–Signal Ground
8–Carrier Detect	F–Receive Line Signal Detect	13–Receiver Ready (A) 31–Receiver Ready (B)
9–Reserved for Testing	m–Reserved for DSU Testing	
		20–Receive Common
10–Reserved for Testing		10–Local Loop (A) 14–Remote Loop (B)
11–Unassigned		3–SPARE 21–SPARE
12–Sec. Carrier Detect		32–Select Standby
13–Sec. Clear to Send		
14–Sec. Transmitted Data		

RS-232C/CCITT V.24	CCITT V.35	RS-449
25 Pin	**34 Pin**	**37 Pin**
15–Transmit Clock (DCE Source)	Y–TX Signal Element Timing o–TX Signal Element Timing	5–Send Timing (A) DCE Source 23–Send Timing (B) DCE Source
16–Sec. Received Data		
17–Receive Clock	V–RX Signal Element X–RX Signal Element	8–Receive Timing (A) 26–Receive Timing (B)
18–Unassigned		18–Test Mode (A) 28–Term in Service (A) 34–New Signal
19–Sec. Request to Send		
20–Data Terminal Ready		12–Terminal Ready (A) 30–Terminal Ready (B)
21–Signal Quality Detector		33–Signal Quality (A)
22–Ring Indicator		15–Incoming Call (A)
23–Data Signal Rate Selector		2–Signaling Rate Indicator (A)
		16–Signaling Rate Selector (A)
24–Transmit Clock (DTE Source)		17–Terminal Timing (A) 35–Terminal Timing (B)
25–Busy		36–Stand by Indicator

D

T1 and E1 Technology Overview

T1 and E1 Development

Digital telecommunications became a commercial reality in the 1960's with circuits installed by American Telephone and Telegraph (AT&T). The driving force for going digital was to create a less expensive and more reliable method of providing telephone service for the long haul circuits down to neighborhood distribution. There was strong economic need to keep the same style of twisted-pair wiring (and in many cases the same actual wires) that had served the analog telephone system.

The requirements for analog telephony was to provide suitable fidelity to represent the human voice. This was accomplished with circuits capable of a little less than 4 kilohertz bandwidth. The analog voice signal usually needed to be amplified many times as it traveled from one end to the other on long haul circuits. Each amplification stage produced additive effect of noise onto the signal. The main reasons for the development of digital communications technology was that a signal could be digitally amplified (regenerated) without introducing the additive noise and the availability of relatively inexpensive digital computers for use as switching devices to replaced analog components.

To maintain the analog telephone standard of 4 kilohertz bandwidth and to support digital voice communications requires 8000 digital samples per second of the incoming analog signal. Each sample amplitude is converted into an 8 bit digital representation (255 digitally represented amplitudes). Each user's voice is therefore given an 8 bit representation 8000 times per second (64 kilobits/second). In digital terms, 64 kilobits gives suitable fidelity to represent the human voice.

In the United States, AT&T pioneered T1 linking. T1 combined 24 digital voice signals timed sequentially into a frame. The frame can be passed through existing phone lines at an overall rate of 1.544 Megabits providing twenty-four user links on two pair of wires. One pair of wires is used for the out-going signal and the other pair for the in coming signal.

Each T1 frame begins with a framing bit and continues with an 8 bit sample from User 1 (a time slot), an 8 bit sample from User 2, etc., up through User 24. Each frame continues with this pattern. A grand total of 193 bits (1 + 24 X 8) make up a single T1 frame. 1.544 Megabits (8000 X 193) of bandwidth is required to transmit 8000 frames per second.

Over a period of 12 frames (called a Super Frame), the framing bit is set to 1 and 0 in the sequence 100011011100, serving as a synchronizing pattern to facilitate proper recognition of frame boundaries and user channels. This Super Frame scheme is referred to as D4 formatting.

The CEPT E1 system originally started with the same 8000 frames per second sampling rate and 8 bit samples, but it was determined that a faster line rate could be supported, so the E1 rate was set at 2.048 Mbps (or 32 equivalent channels). The first channel is always dedicated to a fixed synchronizing pattern and status, and the sixteenth channel is usually dedicated to channel signalling. This leaves 30 user channels on an E1 link.

An engineering consideration for the T1 and E1 electrical signals is that they must be capable of being transformer coupled. This provides electrical isolation and minimizes noise and interference pickup. To accomplish this requires a signal whose arithmetic average over many bit times is zero. In other works, the line signal must spend the same amount of time positive as negative. This necessitates a bipolar data representation.

In T1 and E1 technology, the line signal is a series of pulses of alternating polarity interspersed with times of no pulses. In Alternate Mark Inversion (AMI), "mark" is defined to be a pulse on the link. You have a pulse for a given bit time when the data is a 1 and you do not when the data is a 0. When two consecutive 1's are to be transmitted, the first pulse is of one polarity and the second is of the same amplitude but opposite in polarity. A transmission error (a Bipolar Violation) occurs when two consecutive marks fail to alternate. Most T1 and E1 hardware can indicate and perhaps count and report Bipolar Violations. A Bipolar Violation at the T1/E1 level will most likely create an error in the user's data or produce a slight "click" in a voice signal.

To achieve maximum throughput, the T1 and E1 systems are designed to provide clocking information within the data flow itself. This requires that there be "marks" often enough to allow clock recovery circuits to function properly. In T1, the minimum density for "marks" is 3 in 24 bit times. In the case of digitized voice, this is no problem because the combination of 8 consecutive 0's is not permitted in the digitizing process.

As long-haul digital links became wide-spread, a direct conversion of customer digital information to the digital links was required. Previously, customer digital data had been used to modulate an analog signal for transmission through an analog phone system. Direct digital data to digital telecom and vice versa saved the cost of the analog modulator, pulse code modulator, pulse code demodulator and analog demodulator. It also provided higher throughputs with reduced errors.

AT&T began digital telecom in the United States by offering Digital Dataphone Service (DDS). Analog modems were replaced with DSU/CSU combinations. The Data Service Unit (DSU) provides the point of connection to the user's terminal equipment (typically through an RS232, V.35, or RS449 interface) and the Channel Service Unit (CSU) provides signal regeneration and the correct interface to the T1 link. The DSU/CSU pair allows the user's equipment to send and receive digital data from the line without analog processing. DDS works well with links configured for AMI with D4 framing.

Part of any telephony system is to provide signaling information regarding the path through the network. The original AT&T scheme in T1 was to use the least significant bit of each channel in the 6th and 12th frames in a Super Frame to provide this signaling information (also called in-band signalling). The users of such digital voice circuits would not be able to perceive the slight signal impairment resulting from an error in every other least significant bit. A data user, however, would experience a data error and a failed transmission. Due to the slight errors inherent with in-band signalling, data users cannot use full 64 kbps data channels. To resolve this problem, data users were given 7 bits each sample, which is a rate of 56,000 bps (7 X 80000). To accomplish this, in all frames except 6 and 12, the least significant bit of each time slot is fixed at 1. Configured in this mode, the longest continuous run of zeros on a DDS T1 link is seven.

The signal bit from the sixth frame of a D4 Super Frame is called the "A" bit and the signal bit from the 12th frame is called the "B" bit. Normal usage for the A bit is to indicate that the channel is inactive (A=1) and for the B bit is to indicate that the remote telephone is ringing (B=1). The maximum rate per channel at which an A or B bit can be changed is 667 times per second (8000 / 12).

AT&T developed a second framing scheme referred to as Extended Super Frame (ESF). The Extended Super Frame is 24 frames long. The additional 12 framing bits are used to provide a 4 kbps management channel and a simple 6 bit cyclic redundancy check (CRC). This CRC is a measure of the quality of the circuit. It is a maintenance tool only and plays NO part in user error recovery. The ESF framing pattern is MRM0MRM0MRM1MRM0MRM1MRM0. The 12 bits marked "M" are used as a 4 kbps maintenance data channel and the 6 bits marked "R" are used to transmit the cyclic redundancy check.

If a T1 link is configured for ESF and 56 kbps channels, then two additional signalling bits, C and D, become available. The A bit is the least significant bit of each time slot of the 6th frame, B is the least significant bit of each time slot of the 12th frame, C is the least significant bit of each time slot of the 18th frame, and D is the least significant bit of each time slot of the 24th frame. The individual bit rates are 333 bits per second (8000 / 24).

It is, however, desirable to give users all 8 bits of each time slot for data. With non-voice binary data in a channel, there is a possibility of long sequences of continuous binary 0. If such data were to be presented to the link as a large number of bit times with no pulses, it would cause trouble for clock recovery circuits. To provide transparency for all possible data patterns and still have "marks" on the line for clock recovery purposes, AT&T created an enhancement to AMI called B8ZS (Bipolar 8 Zeros Substitution).

B8ZS observes the multiplexed T1 data stream looking for 8 contiguous 0's. When found, it replaces them with a special 8 bit-time pattern that looks like Zero, Zero, Zero, Bipolar Violation, Alternate Mark Inverted, Zero, Bipolar Violation, Alternate Mark Inverted (0,0,0,V,A,0,V,A), refer to Figure D-1. If devices recognize that the line is configured for B8ZS operation, these deliberate Bipolar Violations are not counted as errors. Therefore, a maximum of seven continuous zeros can occur in a T1 B8ZS bit stream.

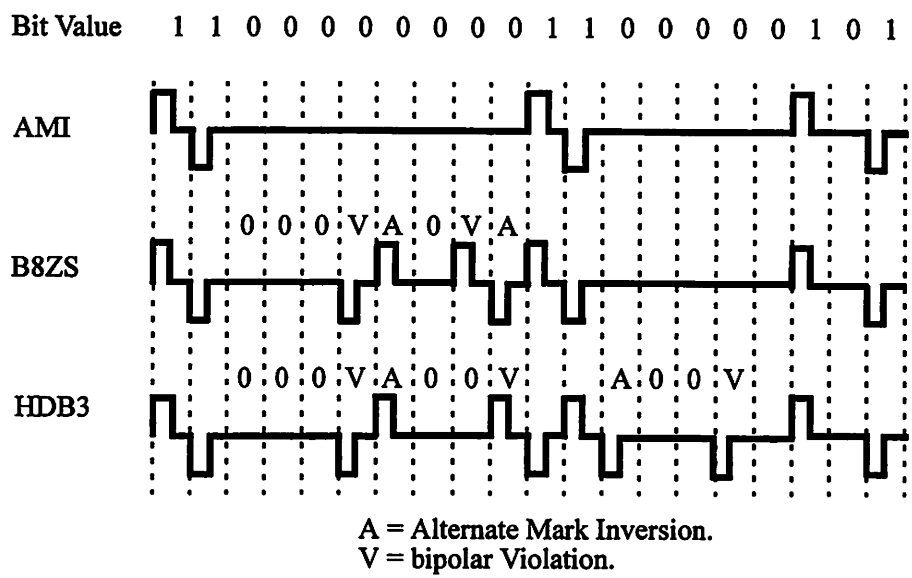


Figure D-1: AMI, B8ZS, and HDB3

E1 defines a "multi-frame" of 16 frames numbered 0 through 15. Even numbered frames carry a Frame Alignment pattern in the first time slot. Frame 0 has more of the pattern in the 17th time slot plus some alarm signalling. Odd numbered frames carry more alignment pattern in the first time slot plus status signalling. For all frames 1 through 15, the 17th time slot carries user signalling information.

E1 has a more stringent requirement than T1 with regard to "1s density" (the ratio of 1s to total bits). The E1 transparency mechanism is called HDB3 (High Density Bipolar 3 zeros max.). The rules for the generation of HDB3 are more complex than that of B8ZS. HDB3 employs two different substitutions. If the number of Marks since the last substitution is odd, the substitution is Zero, Zero, Zero, Bipolar Violation (0,0,0,V). If the number of marks since the last substitution is even, the substitution is Alternate Mark Inverted, Zero, Zero, Bipolar Violation (A,0,0,V). At maximum, three continuous zeros may occur in a E1 HDB3 bit stream.

In both T1 and E1 technologies, the transparency substitutions are made without regard to channel or time slot boundaries.

T1 and E1 devices and testers report link status by indicating a number of conditions that occur on the link. The most basic measurement is Bipolar Violations. This is an indication of an error on the link, either from noise adding a spurious mark to the line, or an intended mark being masked by noise. A bipolar violation occurring in bits of a particular user's channel creates an error in that user's data. If it occurs on a T1 framing bit, it is logged as a framing bit error.

Typical T1 Link Status Indicators

The following are typical T1 link status indicators:

Signal Present:	AMI pulses present at the correct frequency.
Signal Loss:	More than 175 bit times have passed with no AMI pulses.
Frame Sync:	The framing pattern has been detected and data can be retrieved from the time slots.
Frame Loss:	Cannot detect the framing pattern. Most devices will not attempt to deliver time slot data.
B8ZS Present:	The B8ZS substitution pattern has been detected on the link.
BPV: (Bi-Polar Violation)	Bit level link error. A spurious pulse has been injected as noise, or an intended pulse has been missed.
AIS/All 1s: (Alignment Indication Signal)	Continuous AMI pulses on the link without a framing pattern. Indication from upstream that a signal has been lost. System timing is being preserved by the presence of the continuous stream of AMI pulses.
Ones Density or: Pulse Density	T1 specifications require at least 3 marks in 24 bit times. Ones Density is an indication that this rule has been violated.
Excess Zeros:	More than 14 continuous bit times with no AMI pulses on the link.
Yellow Alarm:	Indication to upstream stations that the incoming signal has been lost. Transmitted on the Facilities Data Link when the framing is ESF as eight 1s alternating with eight 0s. Transmitted as a 0 in the second bit

	position of each time slot when the framing is D4. (Note: This can occur accidentally as a result of repeating data.)
ESF CRC Error: (Only with ESF/B8ZS)	The 6 bit CRC indicates an error within the past 24 frames. This is a T1 link quality indicator and plays no part in user error recovery.

When a T1 link is configured for Extended Super Frame, the following messages can be sent on the Facilities Data Link (FDL).

CRC Error Event:	The report of a CRC error on the FDL.
Severe Framing Error:	The report of Frame Loss.
Frame Sync Bit Error:	The report of a bit error affecting the framing bits.
Line Code Error:	The report of a non-B8ZS Bipolar Violation.
Slip Error:	The report of a gain or loss of a bit in the Extended Super Frame. Caused by having independent clocks.
Payload Loop Back:	The report of a device returning the user's data. This is an indication that a device is in test mode.

Typical E1 Link Status Indicators

The following are typical E1 link status indicators:

Signal Present:	AMI pulses present at the correct frequency.
Signal Loss:	More than 175 bit times have passed with no AMI pulses.
Frame Sync:	The framing pattern has been detected and data can be retrieved from the time slots.
Frame Loss:	Cannot detect the framing pattern. Most devices will not attempt to deliver time slot data.
FA Error:	Frame Alignment Error in the framing bits.
HDB3 Present:	The HDB3 substitution pattern has been detected on the link.
Line Code Violation:	Bit level link error. A spurious pulse has been injected as noise, or an intended pulse has been missed.
AIS/All 1s: (Alignment Indication Signal)	Continuous AMI pulses on the link without a framing pattern. Indication from upstream that a signal has been lost. System timing is being preserved by the presence of the continuous stream of AMI pulses.
Remote Alarm:	Upstream indication of a failed link.
CRC-4 Error:	Bit error in previous frame indicated by failed CRC-4. This is an E1 link quality indicator and plays no part in user error recovery.

T1 and E1 Relevant Numbers

The following are T1 and E1 relevant numbers:

8	The number of bits in a T1/E1 time slot. The number of bits per digitized voice sample.
12	The number of T1 frames in a D4 Super Frame.
16	The number of E1 frames in a Multiframe.
23	The number of T1 channels used for data in ISDN Primary Rate.
24	The number of T1 frames in an Extended Super Frame (ESF). The number of 64 kbps channels in a T1 frame.
30	The number of E1 user channels per E1 frame with signalling. The number of E1 channels used for ISDN Primary Rate.
31	The number of E1 user channels per E1 frame without signalling.
32	The total number of E1 channels per E1 frame.
192	The number of Payload bits in a T1 frame.
193	The total number of bits in a T1 frame.
255	The number of sampling levels of an analog voice signal.
2.4 kbps 4.8 kbps 9.6 kbps 19.2 kbps 38.4 kbps	DS0 subrates available in DDS. These reduced bandwidths can be used to provide up to 20-2.4 kbps, 10-4.8 kbps, 5-9.6 kbps, 2-19.2 kbps, or 1-38.4 kbps circuits. Also, redundancy can be utilized to dramatically reduce effective bit error rates.
4000 Hz	Bandwidth (in Hertz) to handle the human voice in telephony.
4000 bps	T1 ESF management channel data rate.

8000	The number of times an analog voice signal is sampled per second. The number of 193 bit T1 frames transmitted per second. The number of 256 bit E1 frames transmitted per second.
56 kbps	AT&T DDS digital data rate (mainly T1).
64 kbps	T1 and E1 user data rate. ISDN "B" channel.
1536 kbps 1.536 Mbps	The Payload bit rate of a T1 link (excludes T1 framing bits) 24 channels, T1 or E1.
1544 kbps 1.544 Mbps	The total bit rate of a T1 link (including T1 framing bits).
1920 kbps 1.920 Mbps	The Payload bit rate of an E1 link with signalling. 30 channels, E1.
1984 kbps 1.984 Mbps	The Payload bit rate of an E1 link without signalling. 31 channels, E1.
2048 kbps 2.048 Mbps	The total bit rate of an E1 link including the sync channel. 32 channels, E1.

Glossary

Glossary

This glossary is a general explanation of terms that are used in this manual. The terms are not necessarily Hewlett-Packard specific, but data communications in general.

AB Bits
T1 voice signalling bits imbedded in users' channels. The A bit is the least significant bit of each time slot in the 6th T1 frame of a D4 Superframe. The B bit is the least significant bit of each time slot in the 12th T1 frame of a D4 Superframe. A=1 indicates that the channel is busy. B=1 indicates that the remote telephone is ringing.

ABCD Bits
T1 voice signalling bits imbedded in users' channels. The A bit is the least significant bit of each time slot in the 6th T1 frame of an ESF Extended Superframe. The B bit is the least significant bit of each time slot in the 12th T1 frame of an ESF Extended Superframe. The C bit is the least significant bit of each time slot in the 18th T1 frame of an ESF Extended Superframe. The D Bit is the least significant bit of each time slot in the 24th T1 frame of a ESF Extended Superframe.

ADCCP (Advanced Data Communication Control Procedure)
ANSI defined HDLC derivative protocol. Common implementations of ADCCP utilize the optional four octet frame check sequence.

AMI (Alternate Mark Inversion)
T1 and E1 electrical technique for transmitting self-clocking data on a link. Normal data representation is to assign a binary 1 to an electrical pulse on the line. This is called the "mark" condition. The next binary 1 to be transmitted must be an electrical pulse of the opposite polarity. Hence, "Alternate Mark Inversion." Binary 0s are represented by bit times with no pulse, called the "Space" condition.

ANSI
American National Standards Institute.

ASCII (American Standard Code for Information Interchange)
Seven bit code providing a total of 128 upper and lower case letters, numerals, punctuation marks, and control characters. Also referred to as CCITT Alphabet Number 5.

Auto Configure
The ability of the Internet Advisor to deduce T1 and E1 framing and coding schemes automatically.

AT&T
American Telephone and Telegraph Company.

B8ZS (Bipolar 8 Zero Substitution)
A special substitution pattern on a T1 link to replace a sequence of 8 zeros with a pattern of zero, zero, zero, bipolar violation, alternate mark inverted, zero, bipolar violation, alternate mark inverted. This substitution is performed to maintain the required "ones density" on the T1 link. The bipolar violations built into this substitution pattern are not counted as errors.

BECN (Backward Explicit Notification Bit)
Frame Relay flow control mechanism used to notify the sending node (or source end) that there is network congestion on the outbound path. The suggested response is to reduce the frame rate into the network.

BCC (Block Check Characters)
The original level 2 error checking scheme for character oriented link protocols. The most common implementations utilized a two byte, algorithmically derived character pair. BCC is equivalent to the CRC-derived FCS in bit-oriented link protocols.

BERT (Bit Error Rate Test)
Tests to quantify line quality. Pseudo-random or stress patterns are passed through a link. The arriving bit stream is compared with the configured pattern and errors are counted and correlated in several ways. (Refer to chapter 6, "BERT Analyzer," for definitions of related terms.)

BPV (Bipolar Violation)
The failure of a T1 or E1 signal to alternate the "mark" pulses, that is, two consecutive "mark" pulses have been of the same polarity.

BOPs (Bit Oriented Protocols)
Level 2 link protocols derived from HDLC.

bps
Bits per second.

BSC (Bisync)
Pervasive but now obsolete character-oriented link protocol developed by IBM for the 2780 remote job entry station in the late 1960s.

Build-Out
T1 expression referring to establishing output signal levels, either in terms of an equivalent length of cable, or in decibels.

CCITT
International Consultative Committee on Telegraphy and Telephony. (French acronym.) Standards group responsible for V, X, and other recommendations concerning voice and data communications.

CEPT
European Post and Telegraph Conference. (French acronym.) Standards group responsible for the international interworking of voice and data systems.

Combined LCN (Combined Logical Channel Number)
The combination of the 4 LGCN and 8 LCN bits into a 12 bit virtual circuit identifier field. The range is 0 to 4095

COP (Character-oriented protocol)
A link protocol utilizing control characters imbedded in the data flow.

CRC (Cyclic Redundancy Check)
A mathematical algorithm to derive the frame check sequence (FCS) in bit-oriented link protocols or the block check characters in character-oriented protocols.

CSU (Channel Service Unit)
A T1 digital signal regenerator straddling the boundary between "outside" (the line to/from the central office) and the "inside" (the DSX-1 signal distribution within the customer premises.) CSUs generally interface to DSUs or Multiplexors on the "inside."

D/E (Discard Eligibility Bit)
Frame Relay mechanism to allow the source of a data stream to prioritize frames indicating those preferred to be discarded in the case of network congestion. If the D/E bit of a frame is set to 1, the frame is a preferred candidate to be discarded.

D4 Super Frame
A group of 12 T1 frames. D4 provides frame synchronization. Refer to Appendix D, "T1 and E1 Technology Overview," for a complete discussion of related T1 terms.

DLCI (Data Link Connection Identifier)
The Frame Relay Data Link Connection Identifier is an address field of 10 bits. The range is 0 to 1023.

DCE (Data Circuit-terminating Equipment)
Modems, line drivers, DSUs, ISDN NT1s and NT2s.

DS-0 (Digital Signal, level zero)
The 64 kbit/s single-channel signal generated by T1 and used in terminal devices such as a channel bank, MUX, or digital PBX.

DSX-1 (Digital Signal Cross-Connect, level one)
The electrical specification for the "Inside" distribution of a T1 signal. This is the recommendation for the connection of a CSU to a DSU or Multiplexor.

DSU (Data Service Unit)
A DCE used to connect the user's interface (typically RS-232, V.35, or RS-449) to the DSX-1 link to a CSU.

DTE (Data Terminal Equipment)
The device at the end of the link. The source or sink of the digital data. DTEs may be CRTs, printers, plotters, PC's, mini-computers, main-frames, or any other device which makes use of a DCE.

E1 Frame
256 bits comprising 31 data channels and a synchronizing channel. 16 E1 Frames constitute an E1 Multiframe. Refer to Appendix D, "T1 and E1 Technology Overview," for additional definitions of E1 terms.

EIA
Electronic Industries Association.

EIA-232D
Successor to RS-232. Common, inexpensive level 1 interface with a specified 20 kbps top speed and 50 feet maximum distance. EIA-232D formalizes the 25 pin and 9 pin implementations.

Equipment
T1 and E1 equivalent of DTE. Also, the data signal generated by the user.

ESF (Extended Super Frame)
A group of 24 T1 frames. ESF provides frame synchronization, quality checking, and a service channel. Refer to Appendix D, "T1 and E1 Technology Overview," for a complete discussion of related T1 terms.

FCS (Frame Check Sequence)
An algorithmically derived representation of a frame. (Typically 16 bits.) The FCS provides error-checking capability. It is computed and appended at the time of transmission and regenerated and compared upon reception.

FDL (Facility Data Link)
A maintenance data channel built into the T1 ESF framing. The data rate is 4 kbps. Refer to Appendix D, "T1 and E1 Technology Overview," for more information.)

FECN (Forward Explicit Notification Bit)
Frame Relay flow control mechanism used to notify the receiving node that there is incoming network congestion.

Fractional E1
An E1 link configured at a aggregate rate less than 1.984 Mbps. The rate will be an integer multiple of 64 kbps.

Fractional T1
A T1 link configured at a aggregate rate less than 1.544 Mbps. The rate will be an integer multiple of 64 kbps or of 56 kbps.

Frame
A structured collection of bits constituting a complete level 2 message. (See also E1 Frame and T1 Frame.)

Frame Relay
A streamlined public network technology well suited to "bursty" traffic typical of LAN interconnection.

HDB3 (High Density Binary 3 zeros substitution)
E1 encoding mechanism to replace 4 consecutive zeros with 1 of 2 substitution patterns containing a bipolar violation. Refer to Appendix D, "T1 and E1 Technology Overview," for a more complete description of the patterns.

HDLC (High Level Data Link Control)
Level 2 link protocol developed by ISO (International Standards Organization). Transmissions are frame oriented; starting flag, address field, control field, optional information field, frame check sequence, and trailing flag. Some specialized derivatives of HDLC give broader definition to the address field, and some omit the control field. HDLC is the most general definition of the bit oriented link protocols.

ISDN (Integrated Services Digital Network)
A more direct user access to digital telephony and data transfer. ISDN is built upon T1 and E1 capabilities and technology.

ISO
International Standards Organization.

kbps
Kilobits per second

LAN (Local Area Network)
A data network engineered for relatively high speed data transfers over limited distances.

LAP-B (Link Access Procedure, Balanced-Mode)
HDLC derivative level 2 link protocol recommended by X.25.

LAP-D (Link Access Procedure, D-Channel)
HDLC derivative level 2 link protocol required by ISDN.

LAP-F (Link Access Procedure, Frame-Relay)
HDLC derivative level 2 link protocol required by Frame Relay.

LCGN (Logical Channel Group Number)
A 4 bit field in an X.25 header serving as part of the virtual circuit identifier. The range of LGCN is 0 to 15.

LCI (Logical Channel Identifier) also called Combined LCN
The combination of the 4 LGCN and 8 LCN bits into a 12 bit virtual circuit identifier field. The range is 0 to 4095

LCN (Logical Channel Number)
An 8 bit field in an X.25 header serving as part of the virtual circuit identifier. The range of LCN is 0 to 255.

Leased Line
Permanent link in a data communication network provided by a commercial communications supplier.

Line
T1 and E1 equivalent of DCE. The signal from the Central Office to the User.

LMI (Local Management Interface)
Frame Relay management protocol controlling the configuration of permanent virtual circuits.

Mark
In T1 and E1, an electrical pulse on the cable. In V-series, the 1's state.

Mbps
Megabits per second.

Monitor
Passive data capture of both sides of a digital communication.

N(R)
Receive sequence number in HDLC based level 2 link protocols.

N(S)
Send sequence number in HDLC based level 2 link protocols.

Network Layer
Level 3 of the seven level OSI reference model defined by ISO. This layer provides the routing of data through the network based on global addresses. Typical examples are IP and X.25.

NRZI (Non-Return to Zero Invert)
Level 1 encoding mechanism in which a binary state is represented by a change of the level 1 signal condition. The other binary state is represented by a continuation of the level 1 signal. In wide area networking, the most common implementation of NRZI encoding is an option in IBM's SDLC. In this case, a 0 is represented by a change in the level 1 signal. A binary 1 is represented by a continuation of the signal. In conjunction with a bit oriented level 2 link protocol, proper clocking may be derived by the receiver independent of DCE clocking.

Nx56
Fractional T1 service description. N is an integer number between 1 and 23.

Nx64
Fractional T1 and E1 service description. N is an integer number between 1 and 23 for T1, 1 and 30 for E1.

Octet
8 bits considered as a transmission element. T1 and E1 octets in general are not equivalent to user's data bytes. "Octet" is more general than "byte," allowing for smaller elements to be contained (1 bit fields, 2 bit fields, and so forth.)

OSI
Open Systems Interconnect. The 7 level communications structure promoted by ISO.

P/F (Poll/Final bit)
One of the bits of a control octet in HDLC derivative level 2 link protocols. In commands it is called the Poll bit. In responses, the Final. Setting this bit to binary 1 in a command requires and immediate response. In a response, it indicates compliance with the command.

P(R)
Receive packet number in X.25 packet headers.

P(S)
Send packet number in X.25 packet headers.

Packet Switching
A network technology in which data transfers are "packetized" and sent through the network one packet at a time. The network assume responsibility for routing the packets.

Physical Layer
Level 1 of the seven level OSI reference model defined by ISO. This layer provides the logical, electrical, and mechanical definitions of a DTE/DCE interface.

PPP (Point to Point Protocol)
HDLC derivative level 2 link protocol common in LAN to LAN connections.

PRBS (Pseudo Random Binary Sequence)
A recognizable sequence of bits which obey most of the rules of statistical randomness. Used to approximate random data flow when performing BERT measurements.

RS-232C/D (EIA-232D)
Common, inexpensive level 1 interface with a specified 20 kbps top speed and 50 feet maximum distance.

RS-449
Logical and mechanical recommendation for a high-speed, high functionality DTE/DCE interface. The required electrical specifications are defined in RS-422 and RS-423. Fully implemented, this interface requires a 37 pin and a 9 pin connector.

SDLC (Synchronous Data Link Control)
HDLC derivative level 2 link protocol defined and widely deployed by IBM. SDLC is a Master/Slave protocol well suited to hierarchical implementations with a single master and multiple slave stations.

Simulation
A process in which the internet advisor actively generates control signals and data as either Equipment/DTE or Line/DCE to provide stimulus to a complementary device.

SNA
IBM's networking protocol suite.

SNAP (Sub Network Access Protocol)
A 5 octet level 2 addendum to facilitate encapsulation of DIX/Ethernet into another LAN or WAN technology. Specifically, the 4th and 5th octets of a SNAP header replicate the Ethertype field of an Ethernet transmission. This serves as an indicator of the protocol stack represented in the transmission.

Space
A condition of a bit time with no pulse on a T1 or E1 link. This usually corresponds to a binary 0 in the data. The signal condition corresponding to binary 0 on a V-Series interface.

T1
AT&T developed, 1.544 Mbps digital interlinking technology.

T1 Frame
193 bits creating 24 data channels plus a framing bit. 12 T1 Frames constitute an D4 Superframe. 24 T1 Frames constitute an Extended Superframe. Refer to Appendix D, "T1 and E1 Technology Overview," for additional definitions of T1 terms.

Time Slot
A specified 8 bits within a T1 or E1 frame.

Toolkit
The user interface for the Internet Advisor.

Transparency
The property of a level 2 link protocol to allow <u>any</u> data pattern to pass though the link without interfering with the link protocol.

UART
Universal Asynchronous Receiver Transmitter. An integrated circuit used to create and receive bit serial data asynchronously.

V-Series Interface
Generic description of the EIA232D, RS-232C/D, RS-449, V.24/V.28, V.35. V.36 DTE/DCE interfaces.

V.24
CCITT equivalent to the RS-232 logical definition.

V.28
CCITT equivalent to the RS-232 electrical specification.

V.35
CCITT level one recommendation based upon the Bell 306 Modem interface. CCITT declared this recommendation obsolete in 1992 and suggests V.36 as an alternative. V.35 is still the primary physical interface for data transmission at and above 48 kbps.

V.36
CCITT level one recommendation to replace V.35. The specified modem is similar to V.35 and the physical interface is similar to RS-449.

Virtual Circuit
An end-to-end logical connection of users without specific paths defined. The Frame Relay and X.25 technique of routing user data through the network.

WAN (Wide Area Network)
A data network engineered for relatively lower speed data transfers over unlimited distances. Often the links in a WAN are provided by a third party.

X.25
CCITT recommendation for robust, public data networks. The basic feature set resembles the voice telephone network combined with the post office. This is the preferred technology in difficult environments, but is being superceded by Frame Relay in areas which have low error-rate data links available.

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Hewlett-Packard Sales Offices

Arranged alphabetically by country

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If no local office is listed for your area, contact one of these headquarters offices.

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Hewlett-Packard Asia Pacific Ltd.
17–21/F Shell Tower
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1 Matheson Street
Causeway Bay
Hong Kong
Tel: (852) 599–7777
Fax: (852) 506–4997

Yokogawa Hewlett-Packard Ltd.
3–29–21 Takaido-higashi
Suginami-ku
Tokyo 168
Japan
Tel: (81/3) 3331–6111
Fax: (81/3) 3335–1478

Canada

Hewlett-Packard (Canada) Ltd.
5150 Spectrum Way
Mississauga, **Ontario** L4W 5G1
Tel: (905) 206–4725
Fax: (905) 206–4739

Eastern Central Europe

Hewlett-Packard GmbH
Lieblgasse 1
P.O. Box 72
A–1222 **Vienna**, Austria
Tel: (43/1) 25000–0
Fax: (43/1) 25000–444
Telex: 134–425

Europe

Hewlett-Packard S.A.
Route du Nant-d'Avril 150
CH–1217 Meyrin 2
Switzerland
Tel: (41) 22/780–81–11
Fax: (41) 22/780–85–42
Telex: 419 019 hps

Latin America

Hewlett-Packard Co.
5200 Blue Lagoon Drive, 9th Floor
Miami, **Florida**, USA 33126
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Fax: (305) 267–4288

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Hewlett-Packard S.A.
International Sales Branch
Middle East/Africa
Rue de Veyrot 39
P.O. Box 364
1217 Meyrin 1
Geneva, **Switzerland**
Tel: (41/22) 780–4111
Fax: (41/22) 780–4770
Telex: 418907

Local Area Offices

Alphabetically by country

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Tirana
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R.T.I.
Realisation Telematiques
Internationales
Lot A, Villa no 57
Bab - Hassen
Wilaya de Tipaza
Algerie
Tel: (213) 230–6430
Fax: (213) 230–6431

Angola

See South Africa

Argentina

Hewlett-Packard Argentina S.A.
Montaneses 2140
1428 **Buenos Aires**
Tel: (54/1) 781–4059/69
(54/1) 781–4090

Australia

Adelaide

Hewlett-Packard Australia Ltd.
191 Fullarton Road
Dulwich, S.A. 5065
Tel: (61/8) 366–5111
Fax: (61/8) 332–0020

Canberra

Hewlett-Packard Australia Ltd.
Thynne Street, Fern Hill Park
Bruce, ACT 2617
Tel: (61/6) 251–6999
Fax: (61/6) 251–6948

Melbourne

Hewlett-Packard Australia Ltd.
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Blackburn, VIC 3130
Tel: (61/3) 272–2895
Fax: (61/3) 898–7831

Perth

Measurement Innovation (WA) Pty. Ltd.
55B Duncraig Road
(P.O. Box 313)
Applecross, W.A. 6153
Tel: (61/9) 316–2757
Fax: (61/9) 316–1392
Mobile: 61–18–33–6434

Sydney

Hewlett-Packard Australia Ltd.
17–23 Talavera Road
North Ryde, N.S.W. 2113
Tel: (61/2) 950–7444
Fax: (61/2) 888–9072

Austria

Hewlett-Packard GmbH
Lieblgasse 1
A–1222 **Vienna**
Tel: (43/1) 25000–0
Fax: (43/1) 25000–444

Bahrain

BAMTEC
P.O. Box 10373
Mezzanine Floor, Al-Hasan Bldg.
Diplomatic Area
Manama
Tel: (973) 53–66–43
Fax: (973) 53–66–67
Telex: 8550 WAEL BN

Belgium

Hewlett-Packard Belgium
S.A./N.V.
Boulevard de la Woluwe
100/102 Woluwedal
B 1200 **Brussels**
Tel: (32/2) 778–34–17
Fax: (32/2) 778–34–14

Bolivia

Siser, Ltda
Rosendo Gutierrez 727
Casilla 4084
La Paz
Tel: (591–2) 34–2485
Fax: (591–2) 35–9268

Brazil

Edisa Hewlett-Packard S.A.
Alameda Rio Negro, 750
06454–000 -Alphaville-Barueri-
São Paulo
Tel: (011) 726–8155
(011) 726–8160
Fax: (011) 726–8171

Edisa Hewlett-Packard S.A.
Rua Lauro Mueller, 116
Grupo 803 – Edificio Torre
Rio Sul
22290–160 -Botafogo-
Rio de Janeiro
Tel: (021) 541–4404
Fax: (021) 295–2195

Brunei

Komputer Wisman Sdn Bhd
Room 1, 3rd Floor
Jalan Tutong
BS Begawan
Brunei Darussalem
Tel: (673/2) 23918
Telex: 0809–2447

Bulgaria

S&T Bulgaria Ltd.
Hewlett-Packard Distributor
114 Vasil Levski Blvd.
1504 **Sofia**
Tel: (2) 468429
Fax: (2) 468391

Canada

Canadian Headquarters Office

Hewlett-Packard (Canada) Ltd.
5150 Spectrum Way
Mississauga, Ontario L4W 5G1
Tel: (905) 206–4725
Fax: (905) 206–4739

Alberta

Hewlett-Packard (Canada) Ltd.
150 6th Avenue S. W.
Petro Canada Tower, Ste. 3600
Calgary, Alberta T2P 3Y7
Tel: (403) 262–0777
Fax: (403) 237–9309

Hewlett-Packard (Canada) Ltd.
11120 178th Street
Edmonton, Alberta T5S 1P2
Tel: (403) 486–6666
Fax: (403) 489–8764

British Columbia

Hewlett-Packard (Canada) Ltd.
13575 Commerce Pkwy, Ste. 110
Richmond, British Columbia
V6V 2L1
Tel: (604) 270–2277
Fax: (604) 270–0859

Manitoba

Hewlett-Packard (Canada) Ltd.
200 Graham Avenue, Ste. 1000
Winnipeg, Manitoba R3C 4L5
Tel: (204) 942–4725
Fax: (204) 989–3553

New Brunswick
Newfoundland
Nova Scotia

Hewlett-Packard (Canada) Ltd.
238 Brownlow Avenue, Ste. 103
Park Place Centre
Dartmouth, Nova Scotia
B3B 1Y2
Tel: (902) 468–4725
Fax: (902) 468–4311

Canada (cont'd)

Ontario

London *See Mississauga*

Hewlett-Packard (Canada) Ltd.
5150 Spectrum Way
Mississauga, Ontario L4W 5G1
Tel: (905) 206-4725
Fax: (905) 206-4739

Hewlett-Packard (Canada) Ltd.
2670 Queensview Drive
Ottawa, Ontario K2B 8K1
Tel: (613) 820-6483
Fax: (613) 820-0377

Prince Edward Island
See Dartmouth, Nova Scotia

Quebec
Hewlett-Packard (Canada) Ltd.
17500 Trans Canada Highway
South Service Road
Kirkland, Quebec H9J 2X8
Tel: (514) 697-4232
Fax: (514) 697-6941

Saskatchewan
See Winnipeg, Manitoba

Chile

ASC. S.A.
Austria 2041
Santiago
Tel: (56-2) 274-7676
Fax: (56-2) 223-1912

China, People's Republic of

China Hewlett-Packard Co., Ltd.
5-6/F West Wing Office
China World Trade Center
No. 1 Jian Guo Men Wei Avenue
Beijing 100004
Tel: (86/1) 505-3888
Fax: (86/1) 505-0394
Telex: 085-22601 CTSHP CN
Cable: 1920 Beijing

China Hewlett-Packard Co., Ltd.
7/F, the Electronic Foreign Trade
Building #88
East 2nd Section, Yi-Huan-Lu Road
Chengdu 610051, PRC
Tel: (86/28) 443-2666
Fax: (86/28) 443-2618

China Hewlett-Packard Co., Ltd.
Room 1201-1204, Gitic Plaza Main
Bldg. 339 Huangshi dong Roadoad
Guangzhou 510060
Tel: (86/20) 331-1421
Telex: 44556 GPHGZ CN

China Hewlett-Packard Co., Ltd.
Room 638, Office Building
Shanghai Center
1376 Nan Jing Road West
Shanghai 200040
Tel: (86/21) 279-8668
Fax: (86/21) 279-8943
Telex: 086-33577 CHPSB CN

China Hewlett-Packard Co., Ltd.
4/F Huaqiang Component Building
Zhenhua Road, Shangbu District
Shenzhen City 518031
Tel: (86/755) 368-608
Fax: (86/755) 363-154

Columbia

Instrumentacio, S.A.
Calle 115 No. 11A-10
Bogota
Tel: (571) 612-1313
Fax: (571) 612-0805

Commonwealth of Independent States

Hewlett-Packard Company
Pokrovski Blvd. 4/17 Kv. 12
101000 **Moscow**, Russia
Tel: (7/505) 213-740
Fax: (7/095) 230-2611

Costa Rica

I.S. de Costa Rica
Calle 25, Avenida 6 & 8, No. 648
San Jose
Tel: (506) 233-3722
Fax: (506) 255-3528

Czech Republic

Hewlett-Packard Ceskoslovensko spo
Novodvorska 82
14200 **Praha** 4
Tel: 2/4717321
Fax: 2/47176111

Cyprus

Telerexa Ltd.
P.O. Box 1152
Valentine House
8 Stassandrou St.
Nicosia
Tel: (3572) 44.56.28
Fax: (3572) 44.55.84
Telex: 5845 tlrx cy

Denmark

Hewlett-Packard A/S
Kongevejen 25
DK-3460 **Birkerod**
Tel: (45) 45 99 10 00
Fax: (45) 45 82 06 30

Hewlett-Packard A/S
Brenstrupgaardsvej 13
DK-8200 **Aarhus** N
Tel: (45) 86 78 30 00
Fax: (45) 86 78 30 33
Telex: 37409 hpas dk

Dominican Republic

Esacomp, S.A.
Calle Seminario No. 55
Ens. Piantini
Santo Domingo
Tel: (809) 563-6350
Fax: (809) 565-0332

Ecuador

CYEDE Cia. Ltda.
Avenida Eloy Alfaro 1749
Quito
Tel: (593-2) 44-4224
Fax: (593-2) 44-4223
Telex: 39322548 CYEDE ED

Egypt

ORASCOM
Onsi Sawiris & Co.
P.O. Box 1191
160, 26th July Street
Aguza/Cairo
Tel: (202) 302-69-30
Fax: (202) 344-02-01
Telex: 92768 orscm un

El Salvador

IPESA de El Salvador
29 Avenida Norte 1223
San Salvador
Tel: (503) 26-6858
Fax: (503) 52-7772
Telex: 301 20539 IPESA SAL

Finland

Hewlett-Packard Oy
Piispankalliontie 17
02200 **Espoo (Helsinki)**
Tel: (358/0) 887-21
Fax: (358/0) 887-22-77

Hewlett-Packard Oy
Teknologiantie 6
90570 **Oulu**
Tel: (358/81) 5515144
Fax: (358/81) 5515145

France

Hewlett-Packard France
Test et Mesure
Z.A. de Courtaboeuf
1 Avenue du Canada
91947 **Les Ulis**
Tel: (33/1) 69 82.62.20
Fax: (33/1) 69 82.65.35

Germany

Headquarters
Hewlett-Packard GmbH
Herrenberger Strasse 130
7030 **Böblingen**
Tel: (49) 7031/14-0
Fax: (49) 7031/14-2999

Hewlett-Packard GmbH
Hewlett-Packard-Strasse
61352 **Bad Homburg**
Tel: (49) 6172/16-0
Fax: (49) 6172/16-1309

Hewlett-Packard GmbH
Lützowplatz 15
10785 **Berlin**
Tel: (49) 30/25452-0
Fax: (49) 30/25452-162

Hewlett-Packard GmbH
Schickardstrasse 2
71034 **Böblingen**
Tel: (49) 7031/14-0
Fax: (49) 7031/14-6429

Hewlett-Packard GmbH
Friedrich-Ebert-Allee 26
53113 **Bonn**
Tel: (49) 228/23400-1
Fax: (49) 228/235-315

Hewlett-Packard GmbH
Überseering 16
22297 **Hamburg**
Tel: (49) 40/63808-0
Fax: (49) 40/63808-327

Hewlett-Packard GmbH
Baumschulenallee 20-22
30625 **Hannover**
Tel: (49) 511/9577-0
Fax: (49) 511/9577-126

Karlsruhe *See Waldbronn*

Hewlett-Packard GmbH
Nikolaistrasse 13-23
04109 **Leipzig**
Tel: (49) 341/21635-0
Fax: (49) 341/21635-220

München *See Taufkirchen*

Hewlett-Packard GmbH
Emmericher Strasse 13
90411 **Nürnberg** 10
Tel: (49) 911/9524-0
Fax: (49) 911/9524-140

Hewlett-Packard GmbH
Berliner Strasse 111
40880 **Ratingen**
Tel: (49) 2102/90.50
Fax: (49) 2102/90.5300

Hewlett-Packard GmbH
Eschenstrasse 5
82024 **Taufkirchen**
Tel: (49) 89/61412-0
Fax: (49) 89/61412-300

Hewlett-Packard GmbH
Hewlett-Packard Str. 8
76337 **Waldbronn** (Karlsruhe)
Tel: (49) 7243/602-0
Fax: (49) 7243/602-512

Great Britain

See United Kingdom

Greece

G-Systems
Hewlett-Packard Distributor
76, Ymittou Street
11634 **Athens**
Tel: (30/1) 7264045

Guatemala

IPESA de Guatemala
Avenida Reforma 3-48, Zona 9
Guatemala City
Tel: (502-2) 31-4786
Fax: (502-2) 31-6627
Telex: 3055765 IPESA GU

Hong Kong
Hewlett-Packard (HK) Ltd.
17-21/F Shell Tower
Times Square
1 Matheson Street
Causeway Bay
Hong Kong
Tel: (852) 599-7777
Fax: (852) 506-9261

Hungary
Hewlett-Packard Magyarorszag Kft.
Erzebet kiralyne utja 1/c
1146 **Budapest**
Tel: (36) 1 2524505
Fax: (36) 1 2527441

India
Hewlett-Packard India Pvt. Ltd.
29 Cunningham Road
Bangalore 560 052
Tel: (91/80) 226-9026
Fax: (91/80) 221-0096
Telex: 845-2773/2821 HP IN

Hewlett-Packard India Pvt. Ltd.
Unit-3, B-Wing
Ground Floor, Neelam Center
Hind Cycle Road
Worli, **Bombay** 400 018
Tel: (91/22) 493-7817
Fax: (91/22) 493-7823
Telex: 11-76812 HPIB IN

Hewlett-Packard India Pvt. Ltd.
DBS Executive Centre
8 Acharya J.D. Bose Road
Calcutta 700017
Tel: (91/332) 470-666
Fax: (91/332) 247-4614
Telex: 21-5417/4163

Hewlett-Packard India Pvt. Ltd.
5-9-13 Taramandal Complex
9th Floor, Saifabad
Hyderabad 500 004
Tel: (91/40) 232-413
Fax: (91/40) 231-756
Telex: 425-2422 HPIL IN

Hewlett-Packard India Pvt. Ltd.
Paharpur Business Centre
21 Nehru Place
New Delhi 110 019
Tel: (91/11) 647-2311
Fax: (91/11) 646-1117
Telex: 31-71127 PBC IN

Indonesia
P.T. BERCA Hardayaperkasa
Jl. Taman Tanah Abang III No. 31
Jakarta 10160 Pusat
Tel: (62/21) 385-5381
Fax: (62/21) 380-9166

Ireland
Hewlett-Packard Ireland Ltd.
Hewlett-Packard House
Stradbrook Road
Blackrock, Co. **Dublin**
Tel: (353/1) 284-4633
Fax: (353/1) 284-5134
Telex: 30430

Iran
Evertech
11 bis, rue Toepfler
1206 **Geneve**
Tel: 4122/346 92 92
Fax: 4122/346 86 91
Telex: 421 787

Israel
Computation and Measurement Systems (CMS) Ltd.
11, Hashlosha Street
Tel-Aviv 67060
Tel: (9723) 538-03-80
Fax: (9723) 537-50-55
Telex: 371234 HPCMS

Italy
Hewlett-Packard Italiana S.p.A.
Via G. di Vittorio 9
20063 **Cernusco s/N (MI)**
Tel: (39/2) 92-121
Fax: (39/2) 92-104-069

Hewlett-Packard Italiana S.p.A.
Via Nuova Rivoltana, 95
20090 **Limito (MI)**
Tel: (39/2) 92-12-1
Fax: (39/2) 70-300-456

Hewlett-Packard Italiana S.p.A.
Via Emanuele Gianturco 92 G
80146 **Napoli (Na)**
Tel: (39/81) 73-40-100
Fax: (39/81) 73-40-216

Hewlett-Packard Italiana S.p.A.
Via Praglia 15
10044 **Pianezza (To)**

Hewlett-Packard Italiana S.p.A.
Viale del Tintoretto, 200
00142 **Roma Eur**
Tel: (39/6) 54-831
Fax: (39/6) 54-01-661

Torino *See Pianezza (To)*

Japan
Akita
Yokogawa-Hewlett-Packard Ltd.
Nihonseimei Akita Chuodori Bldg.
4-2-7 Nakadori
Akita 010
Tel: (81/188) 36-5021
Fax: (81/188) 36-5099

Atsugi
Yokogawa-Hewlett-Packard Ltd.
9-32 Tamuracho
Kanagawa 243
Tel: (81/462) 25-0031
Fax: (81/462) 25-0064

Chiba
Yokogawa-Hewlett-Packard Ltd.
WBG Malibu East Bldg. 19F
2-6 Nakase
Mihama-ku, Chiba-shi
Chiba 261-71
Tel: (81/43) 297-0581
Fax: (81/43) 297-0558

Fukuoka
Yokogawa-Hewlett-Packard Ltd.
Daisan Hakata-Kaisei Bldg.
1-3-6 Hakataekiminami Hakata-ku
Fukuoka 812
Tel: (81/92) 472-8731
Fax: (81/92) 473-4745

Hachioji
Yokogawa-Hewlett-Packard Ltd.
9-1 Takakura-cho
Hachioji-shi
Tokyo 192
Tel: (81/426) 42-1261
Fax: (81/426) 45-2631

Hamamatsu
Yokogawa-Hewlett-Packard Ltd.
219-21 Motoshiro-machi
Hamamatsu-shi
Shizuoka 430
Tel: (81/53) 456-1771
Fax: (81/53) 455-2371

Hiroshima
Yokogawa-Hewlett-Packard Ltd.
Nissei-Heiwakoen Bldg.
3-25 Nakajima-cho Naka-ku
Hiroshima 730
Tel: (81/82) 241-0611
Fax: (81/82) 241-0619

Kawasaki
Yokogawa-Hewlett-Packard Ltd.
3-2-2 Sakado
Takatsu-ku Kawasaki
Kanagawa 213
Tel: (81/44) 812-9711
Fax: (81/44) 812-5235

Kobe
Yokogawa-Hewlett-Packard Ltd.
1-3-2 Muroya Nishi-ku
Kobe 651-22
Tel: (81/78) 993-2600
Fax: (81/78) 993-2698

Kumagaya
Yokogawa-Hewlett-Packard Ltd.
Nissei-Kumagaya Bldg.
2-42 Miya-machi Kumagaya-shi
Saitama 360
Tel: (81/485) 24-6563
Fax: (81/485) 24-9050

Kyoto
Yokogawa-Hewlett-Packard Ltd.
Maeda NS Bldg.
518 Akinono-machi Nijyo-Kudaru
Karasuma Nakakyo-ku
Kyoto 604
Tel: (81/75) 211-4301
Fax: (81/75) 211-2833

Mito
Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Bldg.
1-4-73 Sannomaru
Mito 310
Tel: (81/292) 25-7470
Fax: (81/292) 31-6589

Matsumoto
Yokogawa-Hewlett-Packard Ltd.
38 Bldg.
1-4-6 Nagisa
Matsumoto
Nagano 390
Tel: (81/263) 28-8010
Fax: (81/263) 28-8020

Nagoya
Yokogawa-Hewlett-Packard Ltd.
Nagoya Kokusai Center Bldg.
1-47-1 Nakono, Nakamura-ku
Nagoya 450
Tel: (81/52) 571-5171
Fax: (81/52) 565-0896

Omiya
Yokogawa-Hewlett-Packard Ltd.
Mitsui-seimei Omiya Miyamachi Bldg.
2-96-1 Miyamachi Omiya-shi
Saitama 330
Tel: (81/48) 645-8031
Fax: (81/48) 645-8001

Osaka
Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.
5-4-20 Nishinakajima
Yodogawa-ku
Osaka 532
Tel: (81/6) 304-6026
Fax: (81/6) 304-0216

Sapporo
Yokogawa-Hewlett-Packard Ltd.
Sumitomo-seimei Sapporo
Chuo Bldg.
1-1-14 Nanjo-higashi Chuo-ku
Hokkaido 060
Tel: (81/11) 251-1561
Fax: (81/11) 222-3239

Sendai
Yokogawa-Hewlett-Packard Ltd.
Yamaguchi Bldg.
1-1-31 Ichibancho Aoba-ku
Sendai 980
Tel: (81/22) 225-1011
Fax: (81/22) 225-1616

Japan (cont'd)

Takaido
Yokogawa-Hewlett-Packard Ltd.
3-8-20 Takaido-higashi
Suginami-ku
Tokyo 168
Tel: (81/3) 3335-8111
Fax: (81/3) 3335-9123

Toyota
Yokogawa-Hewlett-Packard Ltd.
Nakane-Nissei Bldg.
4-25-18 Nishi-machi
Toyota
Aichi 471
Tel: (81/565) 35-7411
Fax: (81/565) 35-7446

Tsukuba
Yokogawa-Hewlett-Packard Ltd.
Tsukuba-Mitsui Bldg.
1-6-1 Takezono
Tsukuba 305
Tel: (81/298) 51-5141
Fax: (81/298) 51-5381

Utsunomiya
Yokogawa-Hewlett-Packard Ltd.
Chiyodaseimei-Utsunomiya Bldg.
2-3-1 Odori
Utsunomiya 320
Tel: (81/286) 33-1153
Fax: (81/286) 33-1175

Jordan
Scientific & Medical Supplies Co.
P.O Box 1387
Amman
Tel: (962/6) 62-49-07
Fax: (962/6) 62-82-58
Telex: 21456 sabco jo

Korea
Samsung Hewlett-Packard Co. Ltd.
SHP House
25-12, Yoido-dong
Youngdeung po-ku
Seoul 150-010
Tel: (82/2) 769-0114
Fax: (82/2) 784-7084

Samsung Hewlett-Packard Co. Ltd.
18/F Young Nam Tower B/D
111, Shin Cheon-dong, Dong-Gu
Taegu
Tel: (82/53) 754-2666
Fax: (82/53) 752-4696

Samsung Hewlett-Packard Co. Ltd.
3rd F, Hong In Tower Officetel
536-9, Bong Myung-dong
Yusung-gu, **Taejeon**
Tel: (82/42) 828-6701
Fax: (82/42) 828-6709

Kuwait
Al-Khaldiya Electronics & Electricals
Equipment Co.
P.O. Box 830
Safat 13009
Kuwait
Tel: 965/24 59 815
Fax: 965/24 59 852

Lebanon
Computer Information Systems (C.I.S.)
Lebanon Street, Chammas Bldg.
P.O. Box 11-6274
Dora-Beirut
Tel: (961/1) 405-413
Fax: (961/1) 601.906
Tel/Fax: (3579) 514-256
Cyprus-based line
Telex: 42309 chacis le

Malawi
See South Africa

Malaysia
Hewlett-Packard Sales (M) SDN
BHD Ground Floor, Wisma
CycleCarri
288, Jalan Raja Laut
50350 **Kuala Lumpur**
Tel: (60/3) 298-6555
Fax: (60/3) 291-5495
Telex: MA 31011

Penang
Hewlett-Packard Sales (M) SDN BHD
6/F Wisma Penang Garden
42 Jalan Sultan Ahmad Shah
10050 **Penang**
Tel: (60/4) 376-532
Fax: (60/4) 371-027
Telex: MA 41111

Mauritus
See South Africa

Mexico
Hewlett-Packard de Mexico, S.A. de
C.V.
Prolongación Reforma 700
Col. Lomas de Sante Fé
01210 **Mexico**, D.F.
Tel: (52-5) 326-4392
Fax: (52-5) 326-4301

Morocco
SICOTEL
Complexe des Habous
Tour C, avenue des Far
Casablanca 01
Tel: (212) 231-22-70
Fax: (212) 231-65-45
Telex: 27604

Mozambique
See South Africa

Nambia
See South Africa

The Netherlands
Hewlett-Packard Nederland B.V.
Postbox 667
1180 AR **Amstelveen**
Netherlands
Tel: (31/20) 547-6669
Fax: (31/20) 647-8706

New Zealand
Hewlett-Packard (N.Z.) Ltd.
186-190 Willis Street
Wellington
Tel: (64/4) 802-6800
Fax: (64/4) 384-3380

Nigeria
Management Information
Systems Co. Ltd.
3 Gerrard Road
P.O. Box 53386
Ikoyi, **Lagos**
Tel: (2341) 269.34.23
Fax: (2341) 269.34.19
Telex: 23582 DATEC NG

Norway
Hewlett-Packard Norge AS
Drammensveien 169
P.O. Box 60 Skoeyen
N-0212 **Oslo**
Tel: (47) 22-73-56-00
Fax: (47) 22-73-56-19

Hewlett-Packard Norge AS
Boehmergt. 44
N-5037 **Solheimsviken**
Tel: (47) 55-29-00-90
Fax: (47) 55-29-10-72

Oman
IMTAC LLC
P.O. Box 51196
Mina al Fahal
Muscat
Tel: (968) 707-727, (968) 707-723
Fax: (968) 796-639, (968) 797-709

Pakistan
Mushko Electronics (PVT) Ltd.
68-W Sama Plaza
Blue Area, G-7
Islamabad **44000**
Tel: (92/51) 828-459
Fax: (92/51) 816-190
Telex: 54001 Muski Pk

Mushko Electonics (PVT) Ltd.
Oosman Chambers
Abdullah Haroon Road
Karachi 74400
Tel: (92/21) 524-131
Fax: (92/21) 568-2298
Telex: 29094 MUSKO PK

Panama
Electronico Balboa, S.A.
Edif. El Dorado
Ave El Paiscal #30
Apartado 4929
Panama 5
Tel: (507) 36-0722
Fax: (507) 36-1820
Telex: 368-3483 ELECTRON PG

Paraguay
ECSA Equipos Contables S.A.
Calle Estdos Unidos No. 961
Asuncion
Tel: (595-21) 49-0076
Fax: (595-21) 49-7849

Peru
Cia Electro Mdica, S.A.
Los Flamencos 145, Of. 301-302
San Isidro, **Lima** 27
Tel: (51-14) 241-4325
Fax: (51-14) 242-3703

Philippines
The Online Advanced Systems Corp.
2/F, Electra House
115-117 Esteban Street
Legaspi Village, Makati
Metro **Manila**
Tel: (63/2) 815-3810
Fax: (63/2) 816-0590
Telex: 663-274 ONLINE PN

Poland
Hewlett-Packard Polska
Ul. Newelska 6
01-447 **Warszawa**
Tel: 22/375065
Fax: 22/374783
Telex: 813919

Portugal
Hewlett-Packard Portugal S.A.
Rua Gregório Lopes, Lote 1732A
Torre de Sto. António
1400 **Lisboa**
Tel: (351/1) 301 7330
Fax: (351/1) 301 6332/3

Puerto Rico
Hewlett-Packard Puerto Rico (3175)
Metro Office Texaco Plaza Suite 100
Caparra Heights, PR 00920
Tel: (809) 793-7800
Fax: (809) 749-5325

Qatar
Qatar Datamations Systems
Al Ahed Building, 5th floor
Al Muthof Street
Doha
Tel: 974/43.99.00
Fax: 974/43.21.54
Telex: 4833

Romania
S&T Romania SRL
Hewlett-Packard Distributor
Sitraco Centre
Blvd. Dimitries Cantemir 1
Etaj II - 210, Sector 4
Bucuresti
Tel: (1) 3237250
Fax: (1) 3237200

Saudi Arabia

Modem Electronics Establishment
P.O. Box 2769
King Abdul Azia St.
Al-Khobar 31952
Tel: (9663) 894 65 48 / 895 17 64
Fax: (9663) 894 46 58
Telex: 871106 HPMEEK SJ
Cable: ELECTA, AL-KHOBAR

Modem Electronics Establishment
P.O. Box 1228
Zaben Building, Tahliah St.
Jeddah 21431
Tel: (966/2) 661-1447
Fax: (966/2) 661-0857
Telex: 602712 FARNAS SJ
Cable: ELECTA, JEDDAH

Modem Electronics Establishment
P.O. Box 22015
Prince Musad Ibn Abdulaziz St.
Riyadh 11495
Tel: (966/1) 476-3030
Fax: (966/1) 476-2570 / 476-7649
Telex: 402049 MEERYD SJ
Cable: ROUFKO

Singapore

Hewlett-Packard Singapore (Sales)
Pte. Ltd. 150 Beach Road
#29-00 Gateway West
Singapore 0718
Tel: (65) 291-9088
Fax: (65) 296-7089
Telex: 087-34209 HPSGSO RS

Slovak Republic

High Performance Systems
Hewlett-Packard Distributor
Polianky 5
844 14 **Bratislava**
Tel: 7/760217
Fax: 7/763408

Slovenia, Croatia, Macedonia

Hermes-Plus
Hewlett-Packard Distributor
Celovaska 73
61000 Ljubljana
Slovenia
Tel: 61/193322
Fax: 61/55597

South Africa

HiPerformance Systems (Pty.) Ltd.
P.O. Box 120, Howard Place
7450 **Cape Town**
Tel: (27/21) 685-7922
Fax: (27/21) 685-3785

HiPerformance Systems (Pty.) Ltd.
Private Bag, Wendywood
2144 **Sandton**
Tel: (27/11) 806-1000
Fax: (27/11) 806-1213

Spain

Hewlett-Packard Española, S.A.
Avda. Diagonal, 605
08028 **Barcelona**
Tel: 93-401 91 00
Fax: 93-430 84 68

Avda de Zugazarte
Hewlett-Packard Española, S.A.
Avda de Zugazarte, 8
Edif El Abra, 4
48930 Las Arenas, **Guecho**
Tel: 94-481 80 00
Fax: 94-481 80 40

Hewlett-Packard Española, S.A.
Crta N-VI km 16,500
28230 Las Rozas, **Madrid**
Tel: 1-631 16 00
Fax: 1-631 18 30

Hewlett-Packard Española, S.A.
Luis de Morales, 32
EdificoForum
41018 **Sevilla**
Tel: 95-453 29 10
Fax: 95-453 30 92

Hewlett-Packard Española, S.A.
plaza de America 2-5l
46004 **Valencia**
Tel: 96-395 74 75
Fax: 96-395 42 11

Vizcaya *See Guecho*

Sri Lanka

Precision Technical Services (PVT) Ltd.
65/14, Park Street
Colombo 2
Tel: (941) 687791
Fax: (941) 687731

Suriname

Surtel, Co., Inc.
Grote Hofstraat 3-5
P.O. Box 155
Paramaribo
Tel: (597) 47-7880
Fax: (597) 42-0053

Sweden

Hewlett-Packard Sverige AB
Box 19
Skalholtsgatan 9
164 93 **Kista**
Tel: (46/8) 444 20 00
Fax: (46/8) 444 25 25

Hewlett-Packard Sverige AB
Vädursgatan 6
Box 5328
402 27 **Göteborg**
Tel: (46/31) 35-18-00
Fax: (46/31) 35-18-99

Hjälmaregatan 3
Box 371
201 23 **Malmö**
Tel: (46/40) 660 72 00
Fax: (46/40) 660 72 99

Hewlett-Packard Sverige AB
Jägersrovägen 160
Box 28066
200 28 **Malmö**
Tel: (46/40) 22-79-00
Fax: (46/40) 22-79-99

Service Office
Hewlett-Packard Sverige AB
Arabygatan
Box 3161
350 43 **Växjö**
Tel: (46/470) 396-06
Fax: (46/470) 154-05

Switzerland

Genève *See Meyrin*

Hewlett-Packard (Suisse) SA
39, rue de Veyrot
CH-1217 **Meyrin 1**
Tel: (41) 22-780 41 41
Fax: (41) 22-780 42 20

Hewlett-Packard (Schweiz) AG
Meriedweg 11
CH-3172 **Niederwangen (Bern)**
Tel: (41) 31-980 31 11
Fax: (41) 31-980 33 90

Hewlett-Packard (Schweiz) AG
In der Luberzen 29
CH-8902 **Urdorf/Zürich**
Tel: (41) 1-735 71 11
Fax: (41) 1-735 77 00

Taiwan, ROC

Hewlett-Packard Taiwan Ltd.
8/F No. 337, Fu Hsing North Road
Taipei, 10483
Tel: (886/2) 712-0404
Fax: (886/2) 718-2928

Chungli *See Taoyuan Hsieh*

Hewlett-Packard Taiwan Ltd.
12th Floor, 10 Syh-Wei 4th Road
Kaohsiung
Tel: (886/7) 330-1199
Fax: (886/7) 330-8568

Hewlett-Packard Taiwan Ltd.
10F, 540, Sec. 1
Wen-Hsin Road
Taichung
Tel: (886/4) 327-0153
Fax: (886/4) 326-5274

Hewlett-Packard Taiwan Ltd.
No. 20 Kao-Shuang Road
Ping-Chen, 32404
Taoyuan Hsieh
Tel: (886/3) 492-9666
Fax: (886/3) 492-9669

Thailand

Hewlett-Packard (Thailand) Ltd.
11/F Pacific Place
140 Sukhumvit Road
Bangkok 10110
Tel: (66/2) 254-6720
Fax: (66/2) 254-6731

Trinidad and Tobago

Borde Communications
1 Valsayn Road
Curepe, P.O. Box 897
Port-of-Spain, Trinidad
Tel: (809) 663-2087
Fax: (809) 645-3352

Tunisia

Precision Electronique
5, rue de Chypre - Mutuelle Ville
1002 **Tunis Belvedere**
Tel: (216/1) 785-037
(216/1) 890-672
Fax: (216/1) 780-241
Telex: (0409) 18238 TELEC TN

Turkey

Hewlett-Packard
Bilgisayar ve Olcum Sistemleri A.S.
Paris Cadesi No3 D.9
06670 **Kavaklidere Ankara**
Turkey
Tel: 90 (312) 425-83-13
Fax: 90 (312) 425-47-45
Telex: 46180

Hewlett-Packard
Bilgisayar ve Olcum Sistemleri A.S.
19 Mayis Caddesi Nova/Baran
Plaza K.12
Sisli 80220
Istanbul
Tel: (90/212) 224 59 25
(12 lines)
Fax: (90/212) 224 59 39

United Arab Emirates

Emitac Ltd.
P.O. Box 2711
Abu Dhabi
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